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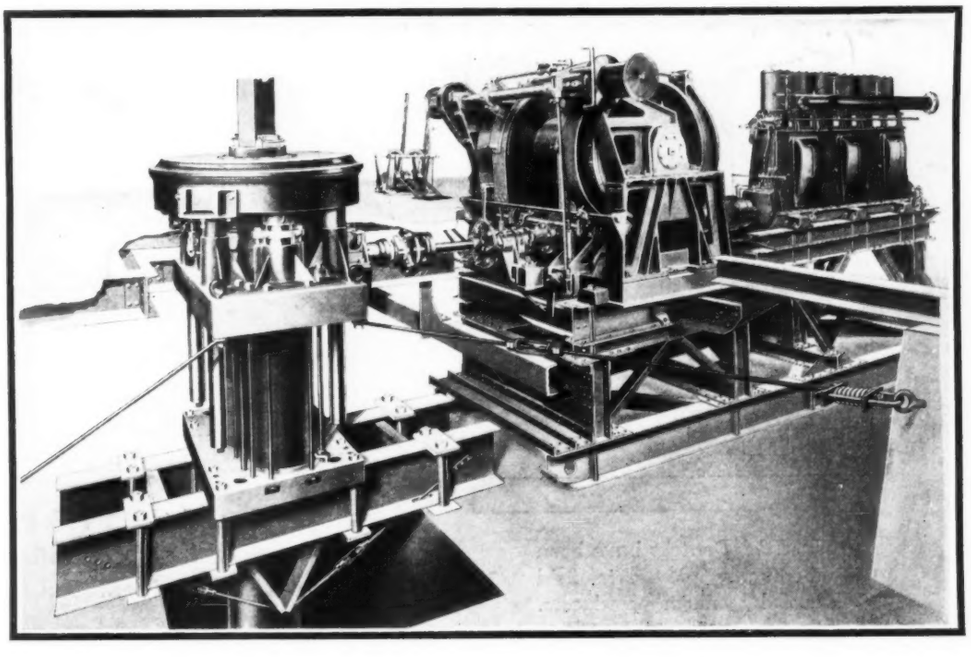

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THE OIL AND GAS JOURNAL

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East Texas Situation Appears to Be Tightening; Railroads Reported Giving Co-operation

By JAMES McINTYRE

IT was reported from East Texas on Monday that all but one railroad were refusing tenders of oil for shipment that were not in conformance with the Texas Railroad Commission's tender requirement order, and the sole exception was expected to be in line by the time this information is published. The Commission in the course of the week extended its order to include all forms of petroleum products making the prohibition against the movement of illegal crude oil products apply to gasoline, kerosene, gas oil, blended gasoline, lubricating oil and blends or mixtures of petroleum.

That part of the order requiring the oil to be identified by well and lease was modified to read that the oil must have been produced in accordance with the commission's orders.

The suit of the Superior Oil Corporation against the commission, which sought to permanently enjoin the commission from carrying out its order, was dismissed on petition of the plaintiff after the order was amended to read that the oil must have been produced in accordance with orders.

Another sign that the Commission's order means business is that while refiners in the East Texas Field are making as much product as usual they are filling their storage with it, because the rigid requirements of the tender order is slowing up the movement to market.

Seventy wells were completed in the East Texas Field in the past week and the field was extended one mile in Upshur County.

A well on the Danbury, Brazoria County, Texas, salt dome, which blew in with a production of 25,000,000 feet of gas at a total depth of 6,290 feet, leads Gulf Coast authorities to believe that another deep seated productive salt dome has been uncovered. The new Coleto Creek Field in Western Victoria County, Texas, had its first sizable oil producing well in a completion of the past week. An 8,771-foot dry hole in the Bosco area, Acadia Parish, Louisiana, defines that field on the north.

One of the most important discoveries in Southwest Texas this year is Lion Oil & Refining Co.'s wildcat three and one-half miles northwest of the old Lucas Gas Field in Live Oak County. It is being completed around 1,320 feet in depth in the Hockleyensis zone of the Jackson horizon, productive in the Fort Bend Field. It is not a large producer, but it is in an area long discounted.

The discovery of oil in Barber County, Kansas, which borders Alfalfa County, Oklahoma, is an interesting feature. The first well, producing from chat, is showing water along with its 200-bbl. showing of oil but it should lead to more exploration of that part of the state, where oil in commercial quantity has never before been found.

Crude Oil Production in the United States

Estimated daily average production for the week ending August 18 and a comparison with previous week and the Federal allowables follow:

		Federal allowable	
Oklahoma—	Aug. 18	August	Aug. 11
Oklahoma City	174,950	.....	195,370
Seminole-St. Louis	102,455	.....	100,825
Remainder of State	239,835	.....	238,805
Total Oklahoma	517,240	480,100	535,000
East Texas—			
Lathrop	208,150	.....	202,015
Kilgore	148,975	.....	146,836
Joiner	132,990	.....	130,995
Total East Texas	485,115	.....	479,846
West Texas	146,321	.....	147,820
North Central Texas	93,579	.....	92,344
Texas Panhandle	61,590	.....	56,325
East Central Texas	53,536	.....	51,197
Gulf Coast—Texas	176,792	.....	175,242
Southwest Texas	59,824	.....	53,636
Total State of Texas	1,076,757	1,001,300	1,056,410
Kansas	134,530	131,200	129,325
North Louisiana	24,760	.....	24,365
Gulf Coast—Louisiana	70,495	.....	67,871
Total Louisiana	95,255	87,200	92,236
Arkansas	31,855	30,400	31,365
Eastern Fields (except Michigan)	102,000	102,200	103,000
Michigan	29,024	33,200	29,899
Rocky Mountain area	98,230	93,500	97,390
California—			
Santa Fe Springs	41,500	.....	41,400
Long Beach	67,000	.....	68,150
Mountain View	7,000	.....	6,250
Elwood	12,500	.....	12,000
Kettleman Hills	62,000	.....	63,000
Remainder of State	318,000	.....	322,200
Total California	508,000	490,200	513,000
Total United States	2,592,891	2,449,300	2,587,625

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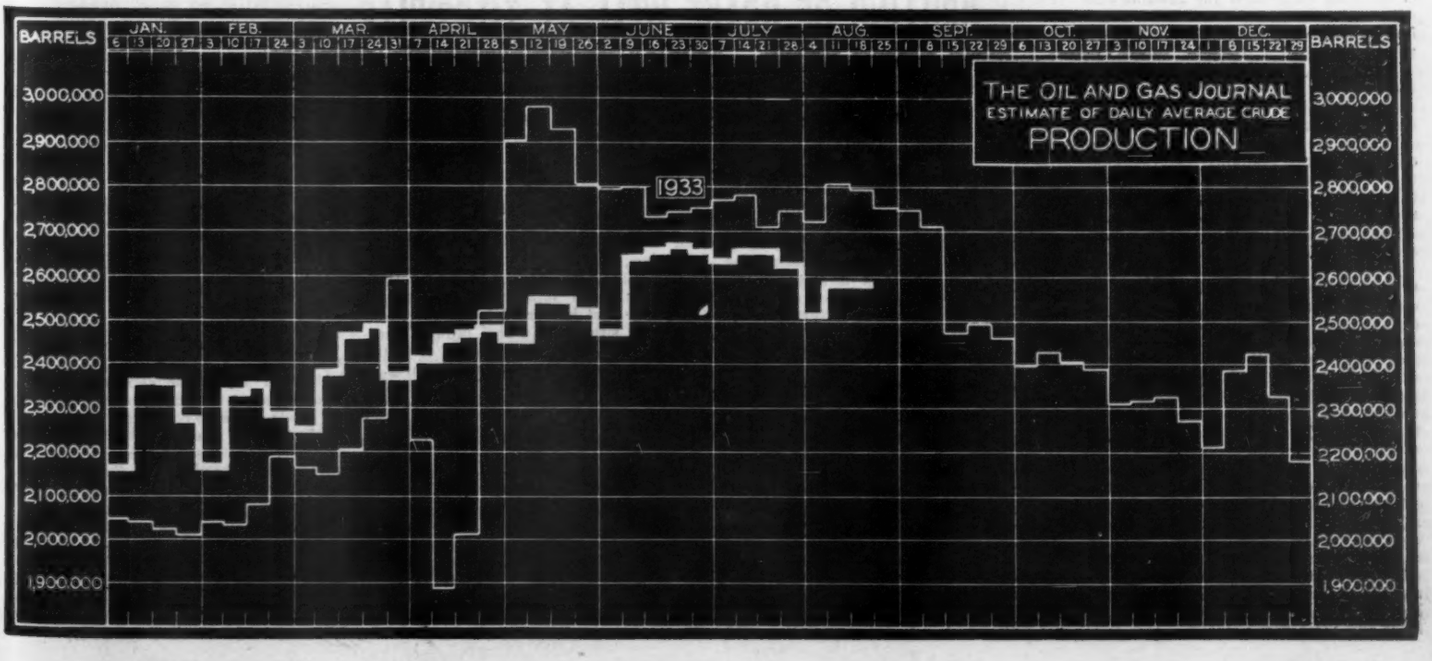


P. & C. PROGRAM COMMITTEE DIRECTED TO EXTEND GASOLINE BUYING PLAN

By HUGH D. MALLON
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Aug. 20.—Plans for extension of the gasoline buying movement from East Texas into other sections are being shaped rapidly by the "stabilization committee," which has changed its name to Program Committee. This committee is to function at least until the end of 1934, and probably will be continued if the program is successful.

To carry out successfully the functions of this body, it is believed by members of the committee it will be necessary to amplify the scope of the committee to include a definite program for the development of outlets for distress gasoline and petroleum products from all sources east of the Rocky Mountains. This broadening of powers is necessary due to the overlapping and interlocking of marketing conditions in various districts of the country.

It is the opinion of the committee that one of the fundamentals necessary for eventual success of this plan is the absolute control of crude production within the limits of actual consumption demand, provision being made for required seasonal accumulations of stocks. This is clearly shown, and the necessity for it emphasized by a resolution adopted by the committee at its first meeting, and which was also included in the minutes of a meeting of the Planning and Coordination Committee. The resolution follows:

Resolution Adopted

"Whereas, it is the experience of this committee that crude allocations during recent months have been in excess of the crude required to meet the gasoline allocations in the same months, after giving due consideration to imports and exports, and

"Whereas, such excess of crude seeking a market is a menace to the stabilization program in that it encourages overproduction of gasoline;

"Therefore, be it resolved by this committee, that the Planning and Coordination Committee be urged to recommend to the Petroleum Administrative Board that future crude allocations be more closely correlated with gasoline allocations."

It is the contention of the committee that if posted crude prices are to be maintained and a sound price structure for products is to be developed it is essential that crude production be held strictly within the limits of current consumption demand for crude, which demand must be accurately calculated on the basis of gasoline production allocations for the individual districts in which the crude from different areas constitutes the gasoline source. Definite elimination of illegally produced crude oil and petroleum products is absolutely necessary as any attempt to develop outlets for volumes of distress gasoline can only end in failure, if supplies of "hot oil" and products continue to provide a method of undermining prices in established markets for legally produced petroleum and petroleum products.

Strengthening of rules under which gasoline production allocations are made are proposed by the committee. They suggest providing allocations only for gasoline produced from legal crude based on sound gasoline demand for districts and for individual refiners in each district. Such regulations it is believed should enable the allocating agencies to refuse allocation to any refiner or refiners who cannot present proof that the production of gasoline for which allocation is asked, will be derived solely from legally produced crude, or from products thereof, or who cannot substantiate the demand for the volume of gasoline production desired.

The primary principle of this committee contemplates the purchase of only distress gasoline as it is believed that no buying program can be practical which contemplates the purchase of any but distress gasoline. Definition, or determination of what is distress gasoline is left to the judgment of the committee.

Authority of Committee

Authority for the setting up of this committee is given in Article 4, Section 6, which says: "In order that the provisions of this article may not operate in such manner as to discriminate against small refining enterprises and in order to assist in orderly liquidation of excessive gasoline inventories the Planning and Coordination Committee may, with the approval of the President, authorize suitable arrangements for the purchase of gasoline from nonintegrated and/or semiintegrated refiners and the resale of same through orderly channels.' The intent of this section will be carried out by developing outlets for the orderly liquidation of excessive gasoline inventories and negotiating suitable arrangements for the marketing of distress gasoline from nonintegrated and semi-integrated refiners. The committee is of the opinion that better and more permanent results could be obtained if it is fully authorized to negotiate purchases either on a spot or a contract basis as in its judgment seems best at the time of purchase. In no case will the period covered by a contract extend beyond the life of the committee.

Terms of purchases may be varied, within the judgment of the committee, but will be aimed at achieving compliance of the refiner with the gasoline allocations of the allocating committee. No commitment for purchase of gasoline extending over a given month will be made until after the gasoline production allocation of the refiner has been set and accepted by him. It shall also be provided in the buying agreements that purchasers under this plan shall receive the benefit of any lower price at which the refiner sells to other buyers during the period covered by the purchase agreement.

May Visit Plants

The committee or its accredited representative shall be given permission under the terms of the contracts of purchase, to visit the plant of the selling refiner for any period necessary to examine the records of receipts of crude and products therefrom, or refinery yields, of all gauges and of all sales and shipments, to observe actual operations, and to make such other investigations as will assure the committee of compliance with the terms of the agreement. The seller further agrees to submit all reports required to the Planning and Coordination Committee or any agency thereof, and to the Bureau of Mines or any other governmental or state agency, and to make any such reports available for check and study by this committee.

It is anticipated that a "Washington Committee of Four,' composed of the chairman, or vice chairman, and of three rotating members, to be appointed by the chairman, will be the nucleus of the organization. This Washington committee will be continuously in session and will be responsible for all current major decisions and for the preparation of weekly reports covering purchase agreements or contracts negotiated, actual volume of purchases by participating buyers, and to check data developed through policing activities.

Local committees of three or more, appointed by the chairman, will be responsible for the direction and supervision of activities of field forces of the Program Committee, namely, the purchase agreement negotiators, and the policing personnel of the committee. Five committees of this type would be set up, one for Louisiana and Gulf Coasts; one for Inland Texas, including East Texas; one for Oklahoma and Kansas; one for Districts 3 and 6b, and one for Districts 1 and 2.

A survey made by the committee has disclosed that purchases of distress gasoline may total for the first month 1,658,000 bbls. from excess stocks and from current production. After the first month, and for the next few months, total purchases necessary to successfully carry out the purchasing program will amount to approximately 1,258,000 bbls., if production allocations are reasonable. A summary of the present stocks of gasoline and current production which will be forced to find a market unless purchased by the committee shows that East Texas will have an estimated 600,000 bbls. of distress gasoline, and Louisiana and Gulf Coast an estimated 700,000 bbls. The balance of the country will have distress gasoline which must be purchased in the approximate amount of 358,000 bbls. Surplus stocks are shown at 400,000 bbls., and are included in the 1,658,000 bbls.

Reports to Be Required

To effectuate the policies and aims of the Program Committee the Planning and Coordination Committee will be requested to pass a resolution calling upon district allocating agencies or allocators to procure reports from each refiner in each district.

One of the reports requested will contain a request from the refiner for the allocation of a definite quota of gasoline to be manufactured during the succeeding calendar month at each refinery of the operator located in the district, and a statement of the quantity of crude or its products that the operator anticipates he will have available during the succeeding month for use in the manufacture of gasoline and the specific sources from which he expects to secure such crude or its products with a showing as to whether or not all of such crude or its products is available from crude to be produced in compliance with the petroleum code and in accordance with valid regulations or orders of the state regulatory body having control over the production of crude, or will be available from crude or its products lawfully withdrawn from storage in compliance with the provision of the code or lawful orders made thereunder, or will be available from crude lawfully imported into the United States. If any part of the crude or its products expected to be available will not be available from that lawfully produced, withdrawn from storage or imported, then a statement of the quantities not so available, and which the refiner expects to use in the manufacture of gasoline must be made. This report must be filed on or before the fourth day of each month in order that the information contained therein may be used for fixing gasoline allocations for the following month. Each report must be filed under oath.

The committee also recommends that a second report, under oath, be required, to be filed on or before the tenth day of each month, beginning with the month of October, 1934. This report will contain a statement as to whether all of

(Continued on Page 27-R)

DIAMOND JUBILEE OF OIL COMMEMORATING DRILLING OF DRAKE WELL AT TITUSVILLE

TITUSVILLE, Pa., Aug. 20.—The seventy-fifth anniversary of the drilling of the Drake well will be celebrated at Titusville, Pa., with a four-day Diamond Jubilee of Oil, starting August 24 and concluding with dedication on August 27 of a state park at the site of the original well. The park, many acres in extent, has been made possible by the citizens of Titusville and the American Petroleum Institute which sponsored the raising of a sum of $60,000 for the erection of a caretaker's cottage and a suitable museum. The commonwealth of Pennsylvania will, on August 27, formally accept the park as state property.

A large sum has been subscribed to provide entertainment for the 50,000 visitors expected and among other features will be an exposition for oil field equipment and machinery manufacturers and for marketers and refiners, the first of its character ever held in the East.

Among other features will be a pageant depicting the history of the oil industry under the direction of personnel of the Carnegie Institute of Technology. Approximately 500 people will be in the cast. A historic and industrial parade is also listed.

Among unusual angles will be the Hall of Hospitality sponsored by the Pennsylvania Grade Crude Oil Association and what is to be known as the Drake Club to which admission will be by card only.

The directors of the American Petroleum Institute will hold a meeting here the day of the dedication ceremony, and Axtell J. Byles, president, a former resident of Titusville, will make one of the speeches at the dedicatory exercises: Governor Pinchot of Pennsylvania has promised to be present as well as Governor White of Ohio, also a former Titusville boy.

The site of the Drake Memorial Park is less than a mile from the city of Titusville and is located in an extremely beautiful site, the natural beauty greatly enchanced by the selection of trees and shrubbery in the foundation planning.

The Drake Memorial Museum is one of the finest small museums in the State, the architecture is pleasing and dignified. This will be the only museum in the world dedicated exclusively to the preservation of oil field historical data and equipment.

The general committee in charge of the Diamond Jubilee of Oil is headed by C. L. von Tacky of Titusville.

Approximately $75,000 are invested in the park and buildings which are a creditable memorial marking the spot where the first oil well was drilled on August 27, 1859.

STABILITY AND CONSERVATION SIGHTED THROUGH CO-OPERATION

By HAROLD L. ICKES
Secretary of the Interior and Petroleum Administrator

The Diamond Jubilee of the oil industry which we are now observing appears to be a fitting time for expressing the sincere belief that stability and conservation, so closely interwoven in petroleum economics, for the first time in history are in prospect of being achieved through the co-operative efforts of the industry and the state and national governments. On September 2 we will enter upon our second year under the petroleum code. We have so far recorded many mutual achievements of which we may all be proud. But in the good American phrase, we have just begun to fight.

I confidently expect that our new year will see the continuation of our progress and our joint program for orderly operations and a vigorous attack upon the serious economic problems demanding solution. To no other industry would the platitude that "times have changed" apply so well as to oil while we are commemorating the Drake discovery well at Titusville 75 years ago. The richest part of the crude oil from that well was worthless in that era. In the intervening years the industry has made tremendous progress. The era of blind drilling has been replaced by scientific methods and equipment. The methods of extracting gasoline from crude oil has been improved. Gasoline and oil engines have provided an outlet for the parts of the barrel of crude oil once tossed to the winds as valueless.

As contrasted with 5,560 wells in 1869, there are approximately 330,000 today. The first iron pipe line of a few miles has been succeeded by a pipe line system of more than 120,000 miles. Investment is now estimated at more than $12,000,000,000.

The industry has become one of the big three in America's economic life. It is closely linked with the general prosperity of the country because of its heavy purchases of materials from mines and factories. It is of paramount importance in our scheme of modern life and has truly been called the lifeblood of this mechanical era of transportation. The mechanical age would have been impossible but for petroleum to furnish in quantity products for power fuel and lubrication.

For a good many years there have been efforts by the states, by the Government and by the industry to organize a co-ordinated program to bring about stability and to prevent excessive production of crude. All these efforts came to naught because of the inability of some of the participating groups to agree to a general plan. Then the National Industrial Recovery Act was passed and the oil code was formulated. These provided a means for unified action to provide stability.

I should not be so foolhardy as to say that we have succeeded in our every aim. We have made considerable progress, and I feel that we shall continue our advances with the continued assistance of the industry, both directly and through the excellent work of the Planning and Co-ordination Committee.

Loopholes have developed in the code machinery. To close them, we sought unsuccessfully at the last session of Congress to obtain statutory authority to carry out our program through more efficient methods. There was not time for adequate consideration of our proposals. I hope that the industry will again join the oil administration for another effort at the next session of Congress in the conviction that the provisions of the code and the act must be reinforced by additional congressional authority to gain our mutual objectives.

We need more powers to supplement and reinforce state agencies in preventing excessive production; and to co-ordinate the proration program of the states, which themselves lack the authority to maintain stability in a neighboring commonwealth.

Enforcement of the labor provisions of the code was necessarily slow in getting started, but progress has been made, and the problems of securing compliance are rapidly being worked out. There have been few major strikes in the industry up to the present. Orderly and stable labor relations are being promoted.

The code has materially affected the marketing branch of the industry. When the code became effective the marketing branch was disturbed by chaotic conditions and prices were at deplorably low levels. Conditions are not yet as orderly as we would like to have them, but this year of rebuilding stands out when compared with the years of chaos which preceded it.

Throughout the administration of the code it has been our definite policy to exhaust all administrative means to obtain voluntary compliance with the provisions of the code before resorting to the courts for enforcement.

This policy is consonant with the sincere co-operative effort made by the majority of the industry to rescue themselves from the unprecedented economic depression. However, in the petroleum industry, as in all fields of human endeavor, there is always a small group of recalcitrants, who will sacrifice the good of the many for their own immediate, selfish gain and who will not conform to any common plan of fair competition unless compelled to do so by the superior force of constituted authority. For the individuals in this group, the National Industrial Recovery Act provides adequate legal machinery, which has been invoked in the past and will be invoked in the future until standards of fair competition throughout the industry are attained and maintained.

—(c) Harris & Ewing.

HAROLD L. ICKES

MESSAGE FROM PRESIDENT ROOSEVELT

In connection with the Diamond Jubilee Number of The Oil and Gas Journal and the Oil City Derrick, commemorating the discovery by Col. Drake, the following message was received from the President:

"I congratulate you upon the commemoration of the Diamond Jubilee of the petroleum industry. I am sure, however, that you are not so much interested in mere felicitations as you are in a message to the industry itself, bearing upon today and tomorrow.

"The nation is dependent upon its petroleum resources, in peace and in war, in its comforts and in its necessities. The nation must, therefore, always be concerned with the protection and utilization of these God-given sources of wealth and these necessary supplies of its individual and domestic life.

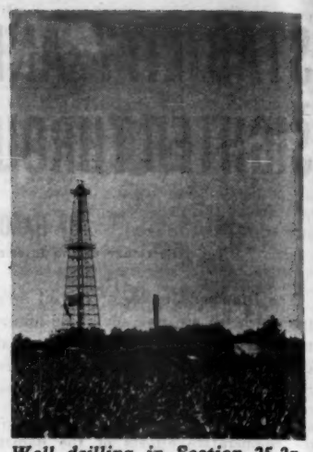
"We call this interest conservation. The government with the industry is now engaged in a program of conservation through the balancing of supply with demand, the control in an orderly manner, of newly discovered and developed sources of supplies.

"Conservation is vital. But it is not all. The petroleum industry is a large part of the whole of industry that must be stabilized so that those who are devoting their lives and fortunes to this huge field of endeavor may share in the well-being of the nation and in the opportunity to insure well-being by fair methods of competition, just wages and working conditions and fair prices.

"I believe that the numerous and complex problems of the petroleum industry are being very vigorously attacked under its code of fair competition and I urge that this effort be sustained and supported.

"Very sincerely yours,
"FRANKLIN D. ROOSEVELT."

FITTS POOL, OKLAHOMA, PRESENTING INTERESTING GEOLOGICAL PROBLEMS



Well drilling in Section 25-2n-6e. Fitts Pool, Pontotoc County, Oklahoma

By L. G. E. BIGNELL
Petroleum Engineering Editor

ADA, Okla., Aug. 18.—This town, the county seat of Pontotoc County, with a population of about 12,000 people, is the center of one of the most active oil field plays in Oklahoma. While the possibilities of the area have long been known to many geologists, it required the completion during the first week in August of J. C. Shaffer and W. A. Delaney's No. 1-A (twin) Hardin, NE NW SW Section 30-2-7, in dolomitic sands at base of Viola lime from 4,069-83, 4,093-4,105 and 4,175-4,200 feet, making 603 bbls. in three hours, and Crosbie and Moran's No. 2 Hardin, NW SE NE Section 30-2-7, which penetrated the same dolomitic sands from 4,180-4,290 feet and flowed an average of 104 bbls. per hour for 14 hours, completed a week later, to start activity.

This area, about 10 miles southeast of Ada, is known as the Fitts Pool and includes the territory south of the north line of Section 18-2n-7e. The development agreement which has been approved limits one well to 10 acres for each producing horizon, and there are five known producing formations in this field. It does not follow that five wells will be drilled on each 10 acres to develop the lease because some leases do not find all five producing formations and in other cases deepening of the original hole will be the best and most economical means of securing the additional production.

There are two wells in Section 18-2n-7e, designated as the Manahan Pool. These produce from shallower formations than those found in the Fitts Pool.

The Fitts Pool activity covers about 6 miles east and west and 3 miles north and south and, with the exception of Section 25-2n-6e, all lies within Township 2 north, Range 7 east, in Sections 18 to 30 inclusive. At this time seven wells are drilling and three rigging up, with six locations staked. The holes are being drilled with rotary and no trouble has been experienced due to shortage of water, in fact, there is an abundance of good water in the area secured from creeks, springs and wells. Gas is used for fuel and there is an abundance of it also.

Home of Andrew J. Harden in southwest corner of his land in Section 30-2n-7e, built and occupied by him since 1882. Gas well in background

An interesting feature of the Fitts Pool area is the exposure of steeply-dipping strata of Paleozoic sedimentaries lying on the flanks of the Arbuckle Mountains which consist of the central core of pre-Cambrian granites. The stratigraphic section as exposed in the mountains ranges from Mississippian age Caney shales to the pre-Cambrian granite and related rocks, with sections of Devonian, Silurian, Ordovician and Cambrian shales, limestones and sandstones.

The formations exposed on the north flank of the Arbuckles are found at depth in the oil fields north of the Canadian River and form the oil and gas reservoir rocks. Many of these strata are crossed by Highway No. 48, that branches south from Highway 19, southeast of Ada, and is locally known as "Murray's Lane."

Where Highway No. 48 crosses a small stream in Section 11-2n-6e sections of the upper Hunton and upper Woodford chert may be seen in a fault. Farther south on this highway in Section 12-1n-6e there are several very excellent exposures of Ordovician formations with Viola lime and upper Simpson members opened in cuts alongside of the road.

Standing on Viola lime at one point on Highway 48 in Section 12-1n-6e it is possible to see the rigs in the Fitts Pool to the northeast over wells drilling into this same formation at a depth of about 4,200 feet. The pool is about 3 miles distant from the outcrop.

In these exposures there are members of some of the well-known oil and gas-producing formations of Oklahoma that are missing in the oil pools. There is an upper Hunton lime member and four sections of the Simpson formation exposed in this area. With the four known strata of Simpson exposed geologists working the well cuttings are reluctant to apply the terms "Bromide" and "McLish" too positively because it is realized that only by fossil evidence can the individual strata of the Simpson be identified.

Early Geology

Prior to 1917 John Fitts, geologist, had worked up acreage in the area south of Ada hoping to interest capital to drill a well to test the Simpson formations at depth at some point relatively close to their outcrop and in 1917 a well was drilled to the Wilcox sand found at about 1,140 feet and asphalt and sulphur water found in the formation that was penetrated for 75 feet. This sulphur water flowed from the well which had a surface elevation of 1,003 feet.

Later another well was drilled to the Wilcox sand at a location north of Ada and in it sulphur water was again found and it also flowed out of the mouth of the casing. These two wells convinced Mr. Fitts that this particular portion of the Wilcox sand was not oil bearing but he persisted in his belief that this formation did contain oil in a portion of the district where it did not directly outcrop at the surface and permit meteoric waters to enter and pick up the sulphur in passing through the formations.

In his study of the area north of the Arbuckle mountains Mr. Fitts recognized several major east-west faults and between these faults there lies a portion of the earth's crust that was not disturbed by movements during mountain building.

Two major uplifts have had great influence upon the whole area. They were the Arbuckle and Lawrence uplifts and while these movements were taking place and great masses of sediments were being thrust under and over each other by tremendous forces at work outside of the area there seems to have been one block of sediments that was affected more by vertical rather than horizontal forces.

The term that has been applied to this particular area, which is about 18 miles long from east to west, 12 miles wide on the east end and about 6 miles wide on the west edge, is "Graben," a German word meaning "grave." In the geological study of Europe there are districts where portions of the earth's crust have formed plateaus and troughs and these downward movements are called "Graben."

However, in the Fitts Pool area the portion of the formations that have been referred to as "Graben" have not dropped down, according to the opinion of Mr. Fitts, but rather this area has remained stationary with relation to the sections north and south of it and while great movements of sedimentary rocks have taken place all around the Fitts Pool area the sediments in the so-called Graben have moved but little horizontally.

Theory Tested

After drilling the two Wilcox water wells in 1917, Mr. Fitts was convinced that the sedimentaries of this so-called Graben area contained gas and oil. Mr. Fitts reasoned that the original hydrocarbons contained in these particular sands, shales and limes had not escaped nor had surface waters entered the formations. Subsequent tests indicate that this theory is at least partially correct for oil and gas have been found in the Hunton, Viola and upper portion of the Simpson formations, also salt water, apparently trapped in the Wilcox sand when the mountain building movements started.

In 1929, or thereabouts, McCraw and Whitney drilled the original test well within the undisturbed areas in Section 35-1n-8e, and found some oil at 38-40 gravity in the Wapanucka lime at about 1,860 feet. This formation was penetrated to 1907 feet and the well was rated at 35 bbls. daily capacity.

Not satisfied with this showing the hole was carried on down to the Wilcox sand at 4,763 to 4,769 feet and salt water encountered.

The next test in the area was put down by Gus Delaney, and B. C. King of Ada, and Sam Miller of Tulsa who started a well with a spudder in 1932 and at 900 feet got into difficulties and stopped operations for a while. They tried to secure money to complete the test but found no one interested, and it was not until some time later that drilling was resumed and a gas sand found at about 1,185 feet which had sufficient pressure to blow the tools up in the hole and cause a fishing job.

Rotary tools were then secured and the hole carried past the upper high pressure gas sand successfully and it found another gas sand at about 1,700 feet in the Atoka formation that is reported to have been rated at 56,000,000 feet daily capacity. This well was completed to the lower gas sand in February, 1933.

Later Developments

Prior to the fall of 1933 A. I. Levorsen, consulting geologist at that time, worked the area and Fred G. Moser, land man, blocked the acreage which was acquired by Harry L. Wirick and A. D. Cochran of Okmulgee, Okla. Moser, Wirick and Cochran later made a deal

with Edward H. Moore of Tulsa to drill a test well which was started in Section 29-2n-7e and described as No. 1 Wirick, because the land had been acquired in fee. Standard tools were used and the Hunton lime topped at 3,117 feet and gas found.

The base of the Hunton is reported at 3,436 feet, giving it a thickness of 329 feet and near the base of this formation oil was found and a 65-bbl. capacity well completed with a total depth of 3,451 feet. This well is located upon 200 acres in Section 29-9n-7e, and attracted considerable favorable attention to the area. The well was finished in August, 1933.

The second well, drilled by E. H. Moore and others, was a north offset to the one described above and it found the Viola lime and drilled deeper to find oil in the top of the Simpson with the total depth of the hole at 3,990 feet. This well, No. 2 Wirick, is reported as good for 60 bbls. per hour and it is not known how much Simpson formation lies below the bottom of the hole but in two other wells in the pool the interval between the Viola and top of the Simpson is practically the same as in the Wirick well.

Correlating the logs of E. H. Moore's No. 1 Wirick, J. C. Shaffer's No. 1-A (twin) Hardin, Crosbie and Moran's No. 2 Hardin and W. A. Delaney's No. 2 Craddock, NE cor. Section 25-2-6e, shows that the interval between the top of the Viola and the top of the producing formation is about the same. Penetrations into the producing formation found below the Viola lime have been of different depths in the four wells considered and it is therefore not known at this time how much pay may be present or whether there are other producing formations of Simpson age beneath the present producing horizon in these four wells.

Whether this producing formation is the Bromide, a sandy, dolomitic limestone with some green shale and thin sandstone as named by Ulrich in 1911 from a small town on the eastern side of the Arbuckle uplift in Johnson County, or one of the upper phases of the Simpson formation is a question now being discussed by the geologists with opinions divided.

Drilling Practice

The wells now being drilled are using rotary outfits, most of them moved in from Seminole and Oklahoma City fields. Two boilers, 122-foot derricks, 7-inch drawworks and two slush pumps are used. The holes are started for 10½, 12½ or 15½-inch surface strings and from 450 to 1,600 feet of casing is set. The casing is cemented and the hole then reduced and carried to the top of the pay horizon where the flow string of 6⅝ or 7-inch casing is set and cemented. One well is finished with a string of 8⅝-inch casing.

The formations provide good mud although in some wells it has been found necessary to add some Ada mud mined locally and formerly sold in the Oklahoma City and other fields where the formations produced poor quality mud. Some admixtures are used, principally Baroid and Aquagel.

May Reduce Allowable

The holes are drilled into the formation and then the wells brought in by washing the mud out of the hole, using clear water introduced through a string of tubing. At this time the daily allowable for the wells is about 125 bbls. and this is produced through the string of tubing, but it is reported that the field allowable may be reduced soon.

The only pipe line now serving the field is a 4-inch branch from the Stanolind Pipe Line Co.'s Seminole district gathering system about 15 miles due north of the Fitts Pool.

There are about six supply companies with warehouses and stocks in Ada and lumber yards in town and in the field.

A number of the major companies have acquired acreage in the Fitts Pool area and with the good showings found at from 4,035 to 4,250 feet in the upper part of the Simpson formation, also good showings from Hunton and Viola limes higher up, that have responded to acidization in one or two wells, it is believed that an active drilling campaign will be carried on this fall and winter.

It takes about 40 days to complete a well and the cost is about $50,000 each.

Ada is located on the Frisco railroad that runs from Tulsa to Fort Worth and Dallas. Good paved highways pass through in all directions and there are good schools, churches and hotel accommodations to be had there. East Central State Normal school is near the town.

The district is very interesting to students of geology because of the abundance of fossils obtainable from many formations. Students from several geological schools in adjacent states have made field trips to the area and many oil companies have sent their paleontologists and geologists to the district to secure type specimens of the important and less known formations to be later studied and classified in the laboratories.

There seems to be no logical reason to confine the future oil developments of southeastern Oklahoma to the vicinity of Ada only because what is true of the formations here may also apply to the entire region to the south and southeast to the Texas and Arkansas boundaries. As the geologists become more familiar with the conditions there it is probable that other areas will be tested and wells are now being drilled near Wapanucka and Atoka that promise much of interest in the very near future.

Viola limestone over Simpson formation exposed in cut on Highway 48, in Section 12-1n-6e, Pontotoc County, Oklahoma

One of the minor faults crossing Highway 48 in Section 11-2n-6e, Pontotoc County, Oklahoma. The light material is Upper Hunton limestone and the dark formation is a section of Upper Woodford chert, the two formations separated by shattered material produced during the earth movements

EAST TEXAS CASE DISMISSED WHEN STATE COMMISSION MODIFIES ITS TENDER ORDER

AUSTIN, Tex., Aug. 20.—The Texas Railroad Commission has amended its order of August 4 which had been enjoined by a Travis County district court and on which a Federal court attack had been launched. The prohibition against movement of illegal crude oil products was made to apply to gasoline, kerosene, gas oil, blended gasoline, lubricating oil, and blends or mixtures of petroleum. The order does not govern the delivery of gasoline by trucks to filling stations for retail trade.

The suit of the Superior Oil Corp. and others against the Railroad Commission's August 4 oil tender ruling, before Federal Judge Bryant, was dismissed on the motion of the plaintiff Saturday because the portions of the ruling objected to were eliminated in the commission's amended order.

F. W. Fischer, counsel for the Superior Oil Corp., said his clients had objected to the provisions demanding sworn statements identifying oil by the well and lease from which it came. Fischer termed that order "impossible," saying, "the oil is gathered in various lines and run to storage, where, becoming intermingled, it would be impossible to state its exact origin." The amended order, Fischer said, calls for statements that the oil is produced in accordance with Railroad Commission orders.

A few hours before the new commission regulation was announced, Judge J. D. Moore of the Ninety-Eighth District Court granted a temporary restraining order preventing the commission from requiring data on the source and ownership of oil refined by the Roco Refining Corp. of Kilgore. He set a hearing for September 17 on the refinery's plea for a permanent injunction.

The Roco refinery pleaded that it produced none of its oil, but purchased it from nearby producers. The oil was run into common tanks before refining, the company said, and it was impossible to provide data on the amount of oil from each well, lease or producer.

While railroad companies are demanding that shippers present Railroad Commission tenders on refined petroleum products, as required by the commission order of August 4, before moving the products in intrastate commerce, they are taking interstate shipments without commission tenders if the Federal Petroleum Administration's shippers' affidavit (O. E. 8. 6) is presented.

During the week ending August 17 tank car shipments gained by 938 bbls. per day, after the new order of the railroad commission went into effect. This brought the daily average shipments up to 1,666 bbls. Runs to refineries increased to 85,855 bbls. per day, an increase of 8,300 bbls. per day over the previous week.

Some of the refiners were said to be worried over the new order, and 33 were shut down during the week whereas during the previous week only 25 were shut down.

Some refiners are said to be taking advantage of the gasoline buying plan to refine more gasoline and sell it to the majors as fast as they can. Taking this third grade gasoline by the majors is not eliminating it, but is only throwing it on the market, leaving empty storage at the small refineries to be filled with more gasoline refined from "hot" oil or oil purchased under the posted price.

Shell Petroleum Corp. is batching the gasoline it is purchasing for shipment by its pipe line to the Gulf Coast where it will be rerun through its Houston refinery to meet its own specifications before being put on the market. Batching this gasoline with its crude shipments eliminates part of the transportation costs. The company was allotted 24,300 bbls. of East Texas gasoline for August and started transporting it through its main line to the Gulf on August 10. Other majors are shipping the gasoline they purchase by tank car, but may also follow the Shell's method and batch the gasoline with oil to Gulf Coast refineries as the majority owning pipe lines from the field have refineries, or have associate company refineries that could rerun the product.

During the week the engineering department of the railroad commission announced bottom hole pressure tests showed the field to have actually gained on average 3 pounds over the average taken in June. The weighted average bottom hole pressure as announced is now 1,227 pounds whereas on June 29 it was only 1,224 pounds. One engineer attributed it to the hydrostatic drive from the west side, which now seems indisputable.

A bitter controversy has arisen in regard to the curtailing of production in East Texas, a group of independent operators protesting against the cut in the allowable while in other fields the allowable remained the same or was increased. These operators will go to Austin, August 22 to argue for a larger allowable for that field. The average well allowable in East Texas was given as 28.863 bbls. per day on August 1. Some of the operators feel the allowable was cut back to take care of excess production from many of the wells, the legitimate operators paying for illegitimate practices.

Commission engineers are said to be

(Continued on Page R-31)

T. V. P. UNIT AT SHELL REFINERY INCORPORATES NEW FEATURES IN CONSTRUCTION AND OPERATION

By A.P. SACHS and W.W. HOLLAND
Petroleum Conversion Corp.

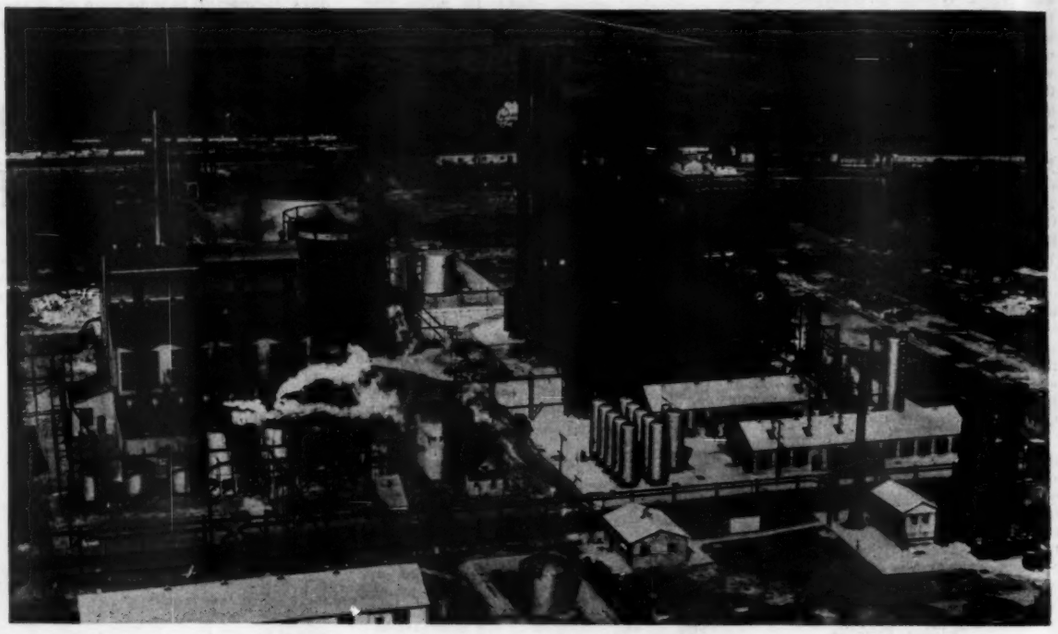
The ideal condition in any cracking operation is one in which the oil or vapor to be cracked is brought up to the desired cracking temperature in the shortest possible time, and with the smallest possible amount of cracking before it has reached the maximum temperature. It should then be heated with absolute uniformity throughout its entire volume for the required length of time to complete the cracking reaction. The products should then be immediately cooled to a degree substantially below the cracking temperature.

By this method of procedure there can be little or no overcracking or undercracking. A minimum amount of permanent gas is produced, gum-forming constituents are formed to a limited degree, and the maximum amount of high octane gasoline is obtained.

However, all cracking processes, both liquid and vapor phase, have followed the relatively slow and progressive method of heating by applying all of the heat to the oil or vapor through the walls of metal tubes. It has been recognized from the beginning that this method of heating has certain disadvantages, the most important of which lies in the impossibility of heating any cross sectional area of the tube contents, from the center to its outer edge, with perfect uniformity. Since heat is applied only to the outside walls of the tube and can be transmitted to the oil or vapor within the tube only through the metal walls, and since oil is a very poor conductor of heat, it is impossible to avoid overheating the oil or vapor film adjacent to the inner tube wall and underheating that in the center of the tube.

Overheating results in overcracking, with the production of a large amount of permanent gas and gumforming constituents. Underheating produces cracked gasoline of low octane rating and of low weight per unit volume; in addition the amount of cracking is limited by underheating.

Attempts have been made to correct this undesirable condition by increasing the rapidity of flow and turbulence within the tubes, but with limited success. The control of "skin temperatures" immediately within the metal tube walls has been the subject of many articles and discussions in relation to furnace design and construction. When one considers the exceedingly short time required to overerack a hydrocarbon at a high temperature and the great number of times in which some portions of the tube contents are exposed to overcracking conditions in the large number of passes throughout the total length of the tubes, the importance of a more desirable method of heat application is quite evident. Likewise, the underheating of the core of the tube contents must be considered. Furthermore, the relatively slow and gradual rise to the predetermined cracking temperature, which is unavoidable in tubular heating, is certainly not to be desired, as this subjects the cracking stock to a variety of cracking conditions of which only one is the most favorable condition.



T. V. P. unit in operation for the past three years at Wood River, Ill., refinery of the Shell Petroleum Corp.

Vaporized Without Cracking

In the T.V.P. operation the oil is first vaporized without cracking. The vapor is then rapidly superheated with a minimum amount of cracking (about 1 per cent) to a temperature 40°-50° F. below that at which it is to be cracked. It is then intimately commingled with a large volume of relatively inert heat-carrier gas which has been heated to a temperature about 100° F. above the established cracking reaction temperature. This results in an instantaneous equalization of temperature at the degree chosen for cracking in any given case. A relatively slow and progressive rise to the cracking temperature is thus completely avoided; the rise is immediate and decisive. The distribution of heat, moreover, throughout the entire volume of vapor is absolutely uniform. There can be no lag in heat transfer from the hot gas to the vapor under the conditions in which the two substances are thoroughly and intimately mixed together.

This instantaneous rise to the desired cracking temperature insures that practically no cracking occurs of the sort which lower temperatures produce. There can be little or no undercracking or overcracking. This condition is reflected in the character of the gasoline produced, which will be referred to later.

In "superheating" the vapor the heat input is so rapid and the time so extremely short that relatively no cracking takes place. Repeated tests have shown that the amount of cracking which occurs at this stage of the operation is of the order of 1 per cent. The vapor is superheated to about 950° F. and the temperature of the heat-carrier gas is about 1,100° F. The two streams are brought together under highly turbulent conditions in a mixing chamber which is held at a constant temperature. This temperature may range from approximately 980° to 1,020° F., depending upon the character of the charging stock. The contents of the mixing chamber then pass into the cracking chamber or reaction zone where the time element is provided for the completion of the reaction. Attempts have been made to locate points of different temperature in the mixing chamber by inserting thermocouples in various places but no such measurable differences have ever been found as would indicate imperfect mixing.

The entire products of cracking are in gaseous or vapor condition and on leaving the cracking zone pass into the recovery system which consists of a scrubber, a rectifier, a condenser and an absorber. The arrangement of the principal parts of the equipment and the movement of the materials through the system are indicated in the accompanying flow diagram.

Heating System

The T.V.P. heating system consists of two parts; first, a tube still heater; and, second, a series of regenerative furnaces called "stoves" which heat the heat-carrier gas. The tube still heater is divided into two sections; the first or vaporizer section heats the oil to a temperature at which most of it will vaporize when flashed; the second or superheater section receives the clean vapor and heats it to a temperature of about 950° F.

The entire vaporizer charge is discharged into a flash drum where vaporization is facilitated by the introduction of hot flash gas. This flash gas acts exactly like highly superheated steam in assisting distillation and carrying over the vapors. The effect is due to the familiar drop in partial pressure occurring whenever steam or other light vapor or gas is introduced into a distilling mass. The flash drum is designed to prevent liquid entrainment and to deliver a clean vapor to the superheater coil.

Function of Stoves

The sole function of the stoves is to heat the heat-carrier gas. This is the gas produced in the cracking operation itself, after it has been stripped of all fractions desirable for motor fuel. It consists of 80-85 per cent of hydrogen and methane, the remaining 15-20 per cent being chiefly ethane and ethylene, with smaller quantities of propane and propylene. Its specific gravity is 0.65-0.70. The cracking stock does not enter the stoves and consequently there can be no cracking of oil or vapor in the stoves.

The stoves are of the conventional blast furnace type so successfully used in the pig-iron industry for decades to preheat the air for the blast furnaces. They have enormous heat-storing capacity and a useful life which is far longer than that of any cracking process. They are very economical in the use of fuel, consuming about 20-25 per cent of the total fuel burned in the process, i.e., only 2.0-2.5 per cent based on fresh charging stock. They are heated in the usual manner, gas being burned in the combustion chamber and the combustion gases carried by natural draft downward through a mass of brick checkers until sufficient heat has been stored in the brick. The hot bricks are then used to heat a current of heat-carrier gas which passes over them.

Stove Operation Continuous

Three stoves are used; one is on blast, i.e., heating the heat-carrier gas; one is relatively cool, having just gone off blast; and one is relatively hot, preparing to go on blast. There is practically no pressure drop across the stoves. It is possible to operate on two stoves so that in rare cases of stove trouble the cracking unit continues uninterrupted.

As the heated gas leaves the stoves

through the hot gas main its temperature is kept constant by automatically bleeding into the gas main a small quantity of cold gas, the amount of cold gas being reduced gradually as the blasting proceeds. As the stove cools and the amount of cold gas bled in reaches zero, the stove is shut off and another stove put on the line.

Having instantaneously raised the temperature of the oil vapor to be cracked from 950° F. to the desired cracking temperature of about 1,000° F. in the mixing chamber the entire volume of gas and vapor passes into the reaction chamber of cracking zone. This is merely an insulated cylinder operating under the system pressure of approximately 50 pounds per square inch, and of such a size that the mixture of heat-carrier gas and oil vapor passes through it in a period of time suitable for the optimum production of gasoline at the selected temperature.

Control of Cracking Temperature

Control of the cracking temperature is one of the most important features of the process and automatic devices are provided which regulate the temperature most rigidly. The T.V.P. process was designed specifically for accurate time and temperature control and it has fully met the requirements. If it is desired to alter the cracking temperature and time of reaction, such a change is made by altering the rate at which either the oil vapor or hot gas, or both, are supplied, and simultaneously the gas temperature is raised or lowered as desired by changing the rate of inflow of cold gas into the hot gas main, and the newly established rates are then kept constant.

Since the hot gas and vapor streams are separately controlled and as the difference in temperature is only about 150° F., and since each stream is kept constant in volume and temperature, the mix temperature is inherently constant. Fluctuations in temperature, therefore, do not occur.

The presence of a large volume of heat-carrier gas which does not enter into the cracking reaction except as a heat-carrier medium, and hence does not fall in temperature because of its own reaction, has a very beneficial effect in the cracking zone, tending to prevent a drop in temperature. It actually lessens the drop in temperature between the entrance to and the exit from the cracking zone. This has an important bearing upon the conversion percentage per pass and upon the character of the products produced because, for a given initial temperature, a higher average temperature is maintained, with smaller deviations from the average temperature.

Single Pass Conversion

The high once-through conversion, also known as the single pass conversion, is an outstanding feature of the T.V.P. process. It will average about 32 per cent per pass based upon gas oil, or its equivalent, charged to the unit, and will considerably exceed 40 per cent for charges containing small amounts of naphtha. This high once-through conversion with the attendant low recycle ratios leads to low gas production which is particularly noticeable in the case of the reforming of naphtha which is completely converted in a single pass.

The recycle ratio, i.e., the ratio of the recycle stock to the fresh charge, is extremely low. For gas oil it is approximately 1:1; for kerosene 0.5:1; and for naphtha alone it is 0:1. This means that for every barrel of fresh gas oil, for example, that is fed to the system, 2 bbls. will ultimately pass through the superheater and reaction chamber.

The above conditions are reflected in the low fuel consumption which will average about 9-10 per cent of the fresh charge when the charge is an overhead distillate such as gas oil. This includes the fuel for both the tubular heaters and the stoves and is extremely low for a vapor phase process. The fuel consumption is lower when crude or reduced crude is charged. The tubular heaters (vaporizer and superheater) consume about 75 per cent of the total fuel burned and the stoves about 25 per cent. Fuel consumption is comparable with any of the liquid phase processes.

YIELDS WHEN CHARGING VARIOUS TYPES OF STOCKS

Per cent yields—	Charging stocks: S.R. naphtha	Kerosene	Gas oil	Reduced M.C. crude
Gasoline, 410° F. E.P., 73.5 octane, M.M.	87	32	67	60
Fuel oil	4	8	20	30
Gas	9	10	13	10

Per cent yields—	Charging stocks crude: Mid-Cont.	East Texas	Kettl. Hills	Signal Hill	Semi-nole	Van Zandt	Sterlitomak Russian)*
Gasoline, 410° F. E.P., 74 oct., M.M.	69	71	73	67	74	71	51
Fuel oil	23	21	20	25	19	22	42
Gas	8	8	7	8	7	7	7

*Sterlitomak (Russian) crude contains 30 per cent of natural asphalt.

The scrubber, which is actually a preliminary rectifier, receives the total products from the reaction chamber. The gaseous cracked products pass upward countercurrent to a descending stream of liquid consisting of flash drum bottoms and recirculated bottoms from the scrubber itself. If the fresh charging stock contains no gasoline fractions this may also be used as scrubber washing liquid.

Since the scrubber receives from the cracking chamber a mixture of oil vapor and incondensible gas it operates under partial pressure conditions. The heat-carrier gas having performed its function of providing heat for the cracking reaction now assists in the distillation which occurs in the scrubber. This is equivalent to a superheated steam distillation, making a deep cut into the residuum and producing large quantities of clean overhead distillate which are fractionated out as bottoms in the rectifier, serving as fresh or recycle charging stock for the cracking operation.

Partial Pressure Conditions

Due to the partial pressure conditions existing in the T.V.P. distilling units vaporization is most effective. This is best explained in the following manner:

A satisfactory ratio between the heat-carrier gas and oil vapor is 4:10 on the weight basis. On the volume basis, however, due to the difference in density, the ratio is 4 volumes of gas to 1 of vapor, the oil vapor being about 10 times as dense as the heat-carrier gas. The process operates at a gauge pressure of about 50 pounds per square inch, or 65 pounds absolute. Therefore, since the volume ratio of gas to vapor is 4:1, the partial pressure of the heat-carrier gas is four-fifths of 65 pounds or 52 pounds per square inch, and that of the oil vapor is 13 pounds per square inch, or less than atmospheric pressure. Distillation is therefore effected under conditions equivalent to a low vacuum distillation or one involving considerable amounts of dry steam. The effectiveness is increased by the presence of large volumes of dry gas permitting rapid disengagement of vapors.

As an example of the effectiveness of this principle the following is given: A West Texas residuum with 32.5 per cent distilling over at 600° F. in a laboratory test, actually distilled over 70 per cent in the T.V.P. scrubber with a top temperature of 600° F. This operation was carried out in a small unit at Texas City with a higher ratio of gas to vapor than that described above. The scrubber can therefore be relied upon to make as deep a cut as desired into any material supplied to it.

By regulating the degree of recirculation of the scrubber bottoms the gravity of these bottoms can be closely controlled. If extensive recirculation is employed the tower top temperature is lowered with the increased reflux and the residue becomes lighter. If the circulation is limited, less heat is removed, the top temperature rises, and additional fractions distill out, leaving a heavier residue of lower A.P.I. degree. In the case of an asphalt crude the scrubber can be operated to remove all volatile material, yielding a residue asphalt of suitably high melting point.

By regulating the reflux as noted above a low viscosity fuel oil of any desired A.P.I. degree may be obtained.

Bubble Type Rectifier

The overhead from the scrubber containing all the distillable components of the total scrubber contents enters the rectifier which is of the regular bubble tower design and operates in the usual manner. Cooling for the rectifier column is provided by returning to the top of the tower a portion of the condensate, also by circulating cooled rectifier bottoms which have been in heat interchange with the fresh feed stock and fat oil from the absorber.

Because of the continuing partial pressure of the incondensible heat-carrier gas, the top temperature of the rectifier is carried about 100° F. below the endpoint of the distillate. For example, a 400° F. endpoint distillate would come overhead when the top temperature is about 300° F. This low temperature distillation leads to an extremely low content of gum-forming constituents in the distillate which provides a very simple treating problem. Subsequent treatment and rerunning at low temperature with the aid of open steam remove almost completely all gum-forming constituents and yield a thoroughly stable gasoline requiring no gum inhibitor.

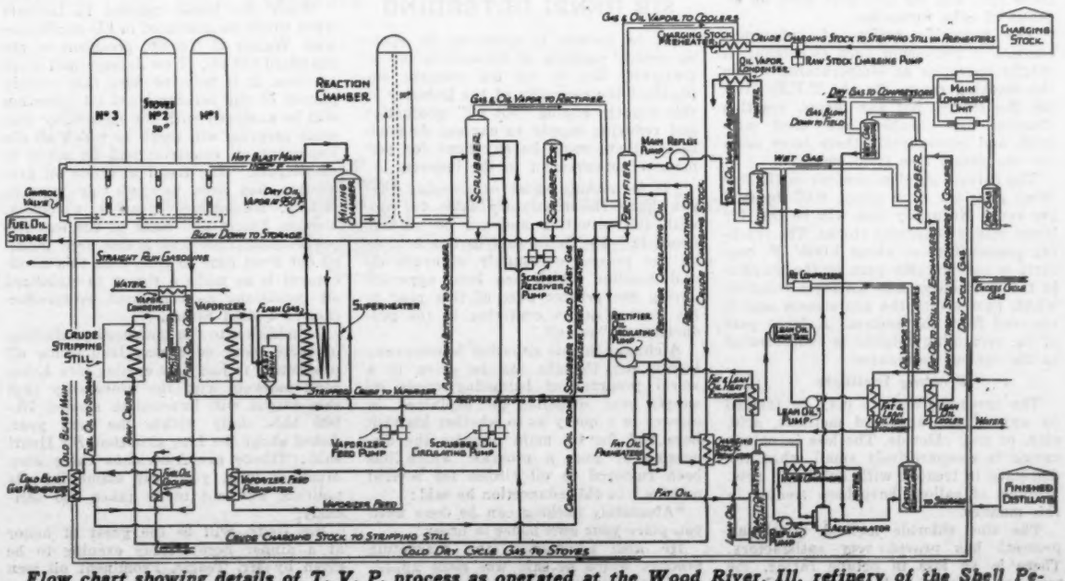
Substantial proof of the above is the fact that during the past three years in regular commercial operation a single T.V.P. unit has produced over 100,000,000 gallons of high antiknock, stable gasoline from a wide variety of charging stocks without ever having used a gum inhibitor.

This may seem remarkable to those whose experience has been with either high temperature vapor phase cracking, i.e., 1,075° to 1,100° F., or with processes using combustion gases as the heat-carrier medium which produce oxygenated compounds which are themselves active gum accelerators.

T.V.P. gasoline not only does not require a gum inhibitor to insure its stability, but the gasoline itself appears to have certain gum-inhibiting qualities. Evidence is available for certain specific cases tending to show that when T.V.P. gasoline is blended with gasoline from other sources the gum content of the blend is lower than that of either of the components, indicating that T.V.P. actually inhibits gum formation.

The induction period of the finished gasoline as determined by the accelerated oxydation test is four hours plus. The gum content of the gasoline after four hours' exposure to oxygen under the conditions of the test is often as low as 15 mgs./100 cc., which is an extremely low figure.

A sample of T.V.P. gasoline which is now seven years old, and which has been frequently exposed to the air, shows absolutely no visible trace of gum. The explanation of this probably lies partly in the fact that cracking takes place under conditions entirely free from oxygen, carbon monoxide or dioxide, and at relatively low temperatures, of the order of 990° to 1,000° F. Higher cracking temperatures tend to produce large quantities of gum-forming constituents. The conditions under which T.V.P. cracking takes place is also no doubt partly responsible for the low gum formation. As mentioned above, the temperature is raised instantly from a point at which practically no cracking occurs, to the full intensity of the cracking temperature and every particle of the vapor is heated with absolute uniformity, with the result that no part of the vapor is exposed to overcracking or undercracking conditions. The partial pressure condition existing in all of the distilling units, effecting a low temperature distillation, is also an im-



Flow chart showing details of T. V. P. process as operated at the Wood River, Ill. refinery of the Shell Petroleum Corporation

portant contributing factor in the low gum content.

The entire overhead from the rectifier passes to the condenser where the major portion of the gasoline distillate is condensed. The cold gas which originally served as heat-carrier gas, together with the flash gas and the gas produced in the cracking operation, goes to an asbsorber which removes the light gasoline fractions remaining in the gas.

The absorber is of the gas-to-oil type in which the cold gas is washed with cold absorption oil. The absorption oil becomes loaded with light gasoline and passes continuously to a stripping still in which the light gasoline is removed. This is then added to the major portion of the gasoline previously condensed. The dry gas leaving the top of the absorber passes to the compressors and is circulated to the stoves for further use as the heat-carrier medium.

Yields

The T.V.P. process is capable of handling any grade of charging stock that may be vaporized, including highly refractory recycle stocks from other cracking operations. Yields from a number of different charging stocks are given in the accompanying table.

Gasoline produced by this process not only has an exceptionally high octane rating, but for a given boiling point range it has a considerably lower A.P.I. gravity than other gasolines. Its weight is 0.4 to 0.6 pound more per gallon than other cracked gasolines, or 9 per cent more, which when converted into heat energy will give a 9 per cent increase in mileage.

Long Runs

An extraordinary feature of the T.V.P. process is that it produces practically no coke or carbon at any stage of the operation. The rate of heating is so rapid and the time factor so short in the tubular units that no appreciable cracking occurs and no coke is formed. There was a complete absence of coke after a run of 79 days on stream, with vapor charges to the superheater as high as 14,500 bbls. per day. A small quantity of finely divided lamp black is sometimes found at the bottom of the cracking chamber, but this is usually carried over into the scrubber by the gas stream, in amounts so small as not to affect the B.S.&W. content of the fuel oil which averages about 0.2 per cent.

The last nine runs of the T.V.P. unit of the Shell Petroleum Corp. at Wood River, Ill., averaged 61.6 days on stream, handling a total of 3,286,644 bbls. of charging stock consisting mainly of straightrun and cracked gas oil, polymers, stripping tower bottoms (Lachman), pressure distillate bottoms from other cracking operations, and cracked and straightrun naphtha. In no one of these runs was the unit shut down on account of coke formation.

The corrosive action of substances common in petroleum, such as sulphur, is chiefly operative at temperatures within the cracking range. In the T.V.P. process the stoves, hot gas mains, reaction chamber and scrubber are lined with brick and consequently these large units are completely free from corrosion.

The current sulphur content in the finished gasoline runs about 0.07 to 0.09 per cent. Naturally this will be less for lower sulphur charging stocks. The cracking temperature of about 1,000° F. converts a considerable part of the sulphur in the raw charge into hydrogen sulphide which passes into the gas stream and is removed from the system. A large part of the remaining sulphur is concentrated in the various residuums.

Treating Distillate

The cracked distillate may be treated by any of the approved methods, acid, clay, or zinc chloride. The loss in octane rating is comparatively small when the distillate is treated with sulphuric acid. Millions of gallons have been treated in this manner.

The zinc chloride method (Lachman process) has proved very satisfactory. There is no loss in octane rating, the recovery is very high, reaching 97 per cent of the potential gasoline content, and the cost compares favorably with other methods. Absolutely satisfactory color is obtained by any of the standard treating methods. For example, the Lachman process yields 30 plus color without any difficulty.

T.V.P. units may be built of any capacity, up to and in excess of 20,000 bbls. of input per day. The combination topping and cracking unit offers an opportunity of handling any grade of crude with utmost economy, producing as desired straightrun or cracked products, gasoline, naphthas, kerosene, light or heavy gas oils, lubricating distillates, low viscosity fuel oils, high melting point asphalts, and high antiknock gasoline in extremely high yields. Construction and operating costs are competitive with liquid phase processes.

Quality of Stocks

One of the distinctive features of the T.V.P. process is its ability to handle any grade of charging stock from any source whatsoever, from the lightest distillates to the heaviest residuums that may contain any distillate fractions. It may truly be considered the "catch-all" for any refinery. Any highly refractory cycle stock that cannot be cracked by other means, slops, light or heavy "off-specification" materials, emulsions, bottom settlings which do not contain an excessive amount of water, waxes, polymers, reduced crude of high asphalt content, etc., may be sent to the T.V.P. unit and converted into high grade gasoline. Change from one type of charging stock to another is effected without interrupting operations.

Salient Features

The salient features of the process may be summarized as follows:

1. The temperature of the cracking stock is raised instantly from a degree at which practically no cracking occurs to the full intensity of the cracking temperature. Any cracking temperature within a wide range may be arbitrarily selected.
2. There is absolutely uniform distribution of heat throughout the entire volume of vapor during the cracking period.
3. There is no overcracking or undercracking.
4. Permanent gas production is low, 9-12 per cent based upon distillate charged; 8-11 per cent based upon reduced crude charged; 7-8 per cent based upon crude charged.
5. No deposition of coke occurs in any part of the equipment.
6. Runs are long, 70-80 days on stream.
7. Fuel consumption is low, 9-10 per cent based upon distillate charged; 7-8 per cent based upon crude or reduced crude charged.
8. Per cent conversion per pass is high, averaging 32 per cent based upon gas oil or its equivalent charged to the unit and 40 per cent or higher on blends of gas oil and naphtha.
9. Recycle ratio is extremely low; gas oil, 1:1; kerosene, 0.5:1; naphtha, 0:1.
10. Partial pressure conditions prevail in the distillation elements, giving operation equivalent to that under a partial vacuum or for steam distillation.
11. High antiknock gasoline is produced with an octane rating of 72-76 M.M., depending upon the source of the charging stock. Selected stocks yield even higher ratings.
12. The gum content is low.
13. The stability is high with an induction period of four hours plus by the accelerated aging test.
14. For a given range of boiling points, T.V.P. is the heaviest gasoline made, 46-51° A.P.I., more B.t.u.'s per unit volume, 7-9 per cent more miles per gallon.
15. T.V.P. cracked distillate is easily treated by zinc chloride, with no loss in octane rating and with yields of 97 per cent of the potential gasoline.
16. Clean, very low viscosity fuel oil is produced.
17. High melting point pitch or asphalt is produced in the T.V.P. scrubber, if desired.
18. Units can be built of large capacity, up to or in excess of 20,000 bbls. input per day.
19. Construction and operating costs are low.
20. The safety factor is high because of low pressure operation, 50 lbs./sq. in.
21. Any grade of charging stock may be handled. Reforming of naphtha and cracking of other materials can be carried out simultaneously.

The T.V.P. process has been in full commercial operation for three years at the Wood River refinery of the Shell Petroleum Corp. The current run at the time of this writing had produced an average of 4,097 bbls. of distillate per day for 58 days. The maximum distillate output for any one day was 7,315 bbls. (99 per cent off at 437° F.) from 9,850 bbls. of raw oil, a mixture of gas oil and naphtha. This occurred on the twentieth day of the previous run.

Note.—Petroleum Conversion Corp. is the sole owner of the T.V.P. process in the United States. Outside of the United States, N. V. Nieuwe Octrooi Maatschappij of The Hague own all rights in the T.V.P. process, 50 per cent controlled by The Bataafsche Petroleum Corp. and 50 per cent controlled by Petroleum Conversion Corp.

AMERICAN STABILIZATION IS ESSENTIAL TO WORLD MARKET SAYS SIR HENRI DETERDING

NEW YORK, Aug. 20.—"Don't waste today what you can produce tomorrow."

Thus did Sir Henri Deterding, managing director of the Royal Dutch-Shell interests, summarize his views of present conditions in the oil industry in an interview on his arrival here from The Hague for a visit with American oil men. Always strong in his condemnation of overproduction and waste in the oil business, Sir Henri placed the blame for present conditions in the industry on the failure of the United States to adequately carry out its program of balancing supply and demand. Before ending his interview, in answer to questions he spoke on several subjects of interest to the oil fraternity but in all his remarks emphasized the necessity of the industry in this country ending "hot oil" production and reducing supply to current demands before there could be any hope for permanent improvement in the industry.

SIR HENRI DETERDING

"It is nothing short of amazing that you have the regulatory laws to cope with this situation and yet do nothing about it," Sir Henri said in commenting on the present oversupply of crude oil and gasoline which has been apparent during the greater part of this year in the United States centering in the production of "hot oil."

A change in this situation is necessahy before any thought can be given to a world program of balancing crude oil supply and demand, he explained in answer to a query as to whether his visit here had for its main purpose the discussing of such a program which has been rumored in oil circles for several months. In this connection he said:

"Absolutely nothing can be done until you place your own house in order."

He also condemned the marketing practice which he said was more apparent in this country than in any other, of trying to take business from each other. In directing the operations of his own oil interests he has always favored cartel arrangements in the distribution of petroleum products wherever possible.

Asked in regard to prices, Sir Henri indicated that present market levels for crude oil and refinery products were much too low for generally profitable operations. He again pointed out, however, that this situation could not be remedied except through operations controlled to the point that overproduction and its accompanying evils were eliminated.

Increasing Demand

In addition to controlling supply, Sir Henri also emphasized the opportunities for increasing the demand for petroleum products.

"The time is not far off when there will be only Diesel power in railway engines," he predicted. "It is the cheapest method of creating energy to drive trains. Electrification of railways, except for suburban trains, is a thing of the past. Diesel power is far cheaper than electricity. With electricity, if the power plant breaks down, nothing moves, but with Diesel power the railways operate with complete individual power units."

In regard to Diesel fuel and other oils replacing coal, Sir Henri said that "coal should be converted into energy at the place of production. The minute you begin transporting coal you lose money. It is only a matter of time until all ships will be motorized."

In pointing to this large potential market for a fraction of crude petroleum he explained that intelligence should be used in creating new markets and oil should not be used where it is impossible to realize on its superior properties.

International Situation

While Sir Henri refused to indicate what would be discussed in his conference with Walter C. Teagle, president of the Standard Oil Co. (New Jersey) and other oil men, it is believed here that certain phases of the international oil situation will be analyzed with the possibility that some program will result to which all the important oil countries will be asked to participate. The trend in crude oil production has been upward this year in Russia, Rumania, Venezuela, Colombia, Mexico, Persia and some of the less important countries and it has been pointed out from time to time that this development is as much a threat to stabilized oil conditions as continued overproduction in United States.

In addition to the increased production of these older countries, Iraq crude oil production is just now coming into European markets with the probability that this output will increase to around 75,000 bbls. daily within the next year. Asked about the Iraq situation, Sir Henri said: "There are Americans there also. Much of what you hear about Iraq is political and not to be taken too seriously."

Sir Henri will be the guest of honor at a dinner here Friday evening to be given by Mr. Teagle. Prominent oil men and other business leaders will attend.

If octane numbers could talk they couldn't tell the whole story because they have nothing to do with miles per gallon

Octane numbers mean anti-knock value and that is important but it isn't enough for the motorist—he wants the most miles he can get for his gasoline dollar

Dubbscracked gasoline gives him most miles to the gallon—and it's anti-knock, too

There is never enough Dubbscracked gasoline to go round

Universal Oil Products Co
Chicago Illinois

Dubbs Cracking Process
Owner and Licensor

Pacific Coast Petroleum Agency Is Proving to Be Practical Influence in Stabilizing Operations

By L. P. STOCKMAN

LOS ANGELES, Calif., Aug. 20.—The Pacific Coast Petroleum Agency has accomplished in a relatively short space of time what refiners and marketers have been endeavoring to do since the advent of overproduction and the resulting struggle for gasoline gallonage which became acute a number of years ago. Operation of the agency will not prove a panacea for the many ills confronting the oil industry but it does offer tangible evidence that refiners and marketers can so regulate their operations as to remove most of the objectionable practices and proceed with normal ethical business. The Pacific Coast Petroleum Agency agreement may not represent the acme of perfection but it is fundamentally sound in principle and is the result of a concerted attempt to give the little fellow the break to which he is entitled as an integral part of the business. The objective is accomplished by assigning to each refiner his prorata share of the general market, a definite assurance that an ample supply of crude oil and natural gasoline to meet his refinery requirements will be provided and a fair application and enforcement of the covenants of the agreement. There are still a few difficult problems to be worked out but with experience these obstacles will be surmounted, it is hoped, to the mutual benefit of all concerned.

The supplemental agreement, required by the Department of Justice, was signed in the District Court at San Francisco on June 30, and, while the agreement was not to become effective until this consent decree had been modified, subsequent action by the board of directors set the effective date and time as 12 a.m. June 25, which was the date of approval by the petroleum administrator. Within the next few days the agency will have been in operation for a period of two months and unless some unforeseen developments arise the agreement will expire June 15, 1935. Up to the present time, members of the agency have delivered a considerable quantity of crude oil to independent refiners and have at the same time and during the same period purchased a large quantity of gasoline which some refiners failed to market. These transactions have been under the supervision of a representative of the petroleum administrator in order to prevent any irregularities.

Agency Foundation

The basic foundation of the agency is set out in Article 2 of the agreement which provides that its purposes are "to purchase, hold and dispose of fairly and with due regard to market demands, gasoline manufactured on the Pacific Coast by others than members and refiners subsidiary to, or controlled by such members, which the manufacturers thereof may desire to sell and is in excess of the quantity which the manufacturers thereof can market without creating disorderly marketing conditions, and which, if not purchased, would result in the burdening of the gasoline market on the Pacific Coast with gasoline uneconomically distributed, and which would otherwise be sold at prices bearing no proper relationship to the price of crude oil, thereby directly affecting the stability of gasoline markets and the prosperity of the petroleum industry on the Pacific Coast, and leading to price cutting and destructive price wars which affect interstate commerce and frustrate the purposes of the said act and code.

"To purchase, hold and dispose of fairly and with due regard to market demands, crude oil, natural gasoline and other petroleum products produced in California by others than members and producers subsidiary to, or controlled by such members, which the producers thereof may desire to sell and which is in excess of the quantity which the producer can sell without creating disorderly marketing conditions, and to the extent that such crude oil may be available, to sell the same to refiners, and to purchase crude oil from refiners which they have in excess of the amount of refiners' requirements for manufacturing their allotted gasoline under contracts with the agency and to post a price for and to purchase marketable residuum, distillate, and kerosene from refiners who have entered into contracts with the agency."

One of the most important accomplishments by California refiners has been the stabilization of gasoline prices at a level that permits refiners and marketers to operate at a fair profit and which at the same time protect the public interest. The agency, of course, has no direct interest in the price of gasoline although it is obligated to enforce covenants of the agreement which provide that gasoline of the same quality must be sold at the same price. The effect of this has been to stabilize retail prices of all grades of gasoline with the result that price cutting has been minimized. A recent check indicates that major companies have shown substantial increases in gasoline sales but this has been more or less anticipated. This does not indicate that independent refiners are losing business, notwithstanding that sales of their resellers are lower, as the agency agreement provides that major companies must purchase all unsold gasoline manufactured by smaller refiners. In other words, all marketers participate in the actual demand for gasoline in proportion to their percentage of sales as provided in the agreement and for this reason it does not matter who actually sells the gasoline necessary to meet consumptive demands.

The only disconcerting feature in connection with operation of the Pacific Coast Petroleum Agency is the fact that a certain small group of chiselers has come into the picture and may prove a very disturbing factor as time goes on. In addition to this, the importation of Texas gasoline into the Pacific Northwest, particularly in the Puget Sound region, will have a tendency to disrupt prevailing prices if the consignee resorts to price cutting. In Los Angeles Basin and in several other sections of the state, chiselers have resorted to the sale of motor fuel, which because it does not conform with U. S. Motor specifications can not be sold in the state as gasoline. This motor fuel, which is a blend of kerosene, gasoline and natural gasoline, is generally sold from 1 to 3 cents below prevailing prices of gasoline. The agency will probably crack down on stations dispensing motor fuel if any member is delivering gasoline to other pumps in the same station. If the pumps were removed they would find it more difficult to cut prices in the event some state inspector went into the station and was sold gasoline that did not conform with state specifications.

Agency Personnel

Control and management of the agency is vested in a board of directors which consists of one governor appointed by each of the members representing the Associated Oil Co., General Petroleum, Gilmore Oil Co., Shell Oil Co., Richfield Oil Co., Mohawk Oil Co., Rio Grande Oil Co., Rocket Oil Co., Seaside Oil Co., Signal Oil Co., Standard Oil Co., Sunset Pacific Oil Co., Texas Co. and Union Oil Co. In addition to the board of directors, the agency is under direct supervision of W. C. Van Fleet, who has the post of general manager. The remaining personnel consists of W. S. Avery, general counsel; T. O. Egan, chief accountant; W. H. Eaton, Jr., representing the petroleum administrator; O. F. Collinger, in charge of transactions between members of the agency and independent refiners; W. F. Ebert, in charge of invoices; R. A. Duncan, in charge of orders and transportation, and Miss N. A. Dobson, in charge of office management.

S. Bolither, recently elected president of the Shell Oil Co. to succeed George Legh-Jones, who has been made assistant to Sir Henri Deterding, summed up the situation a few days ago when he said that "the oil industry in California is in better condition than it has been in many years and its future outlook is distinctly encouraging. The new agency represents a fair program. It permits the oil companies to make a reasonable profit and it protects the public against unfair prices. Especially does it allow the small operator to operate profitably as evidenced by the fact that a number of small refiners that have been in the red are now showing earnings. I intend to do everything possible to co-operate with other members of the industry in order that stabilized conditions may remain in effect."

J. E. Moorhead Named Pennsylvania Secretary

OIL CITY, Pa., Aug. 20.—J. E. Moorhead has been appointed executive secretary of the Pennsylvania Grade Crude Oil Association, effective October 1, to succeed T. O. Grisell, who goes to Kendall Oil Co. at Bradford as sales manager. The announcement was made by T. P. Thompson, Jr., president of the association, at the close of an executive session of the board in Oil City.

J. E. MOORHEAD

Mr. Moorhead is manager of advertising and sales promotion for Rio Grande Oil Co., Los Angeles, Calif., subsidiary of Sinclair Consolidated Oil Corp. He accepted that post July 1, following his resignation as director of publicity for the Pennsylvania Grade association.

His wide experience in advertising and merchandising has been gained over a period of 15 years since leaving an active newspaper career in the intermountain west. In 1923 Mr. Moorhead was placed in charge of advertising for the Mountain States Telephone & Telegraph Co., at Denver, resigning in 1928 to become advertising manager of the Marland Refining Co. at Ponca City, Okla. The company was merged with the Continental Oil Co., and Mr. Moorhead continued to supervise a large advertising appropriation, sales promotion and sales training.

Administrator's Report on Crude Stocks

Stocks of domestic and foreign crude petroleum at the close of the week ended August 11 totaled 340,387,000 bbls., a decrease of 1,228,000 bbls. from the total of 341,615,000 bbls. on hand at the end of the preceding week, Harold L. Ickes, Secretary of the Interior and administrator of the code of fair competition for the petroleum industry, announced today. This decrease, which followed an increase of 302,000 bbls. during the previous week, comprised a decrease of 1,073,000 bbls. in stocks of domestic crude and a decline of 155,000 bbls. in foreign crude stocks.

Current reports of the industry for the week ended August 11, in comparison with those of the previous week, indicate an increase of 50,000 bbls. in daily average crude oil production, no material change in imports, and a gain in runs to stills of approximately 40,000 bbls. The daily average indicated balance of crude oil for the week ended August 11 was as follows (barrels): Production, 2,560,000; imports, 81,000; decrease in stocks, 175,000, equals runs to stills, 2,540,000. The exports, losses, etc., were 276,000 bbls.

CRUDE PETROLEUM STOCKS REPORTED BY COMPANIES HOLDING 100,000 BBLS. OR MORE

Grade of crude oil—	Stocks held by reporting companies: Aug. 4, 1934 (bbls.)	Aug. 11, 1934 (bbls.)	Change from Aug. 4, 1934 (bbls.)
Pennsylvania Grade	4,670,000	4,747,000	+77,000
Other Appalachian, including Kentucky	1,188,000	1,167,000	—21,000
Lima-Northeast Indiana-Michigan	1,515,000	1,485,000	—30,000
Illinois-Southwest Indiana	11,382,000	11,352,000	—30,000
North Louisiana and Arkansas	10,269,000	10,204,000	—65,000
West Texas and Southeast New Mexico	29,432,000	29,441,000	+9,000
East Texas	39,390,000	38,044,000	—1,346,000
Other Mid-Continent	160,417,000	160,846,000	+429,000
Gulf Coast	17,802,000	17,769,000	—33,000
Rocky Mountain	27,942,000	27,839,000	—103,000
California	34,186,000	34,277,000	+91,000
Total domestic crude	338,194,000	337,121,000	—1,073,000
Foreign crude	3,421,000	3,266,000	—155,000
Total crude	341,615,000	340,387,000	—1,228,000

CHEVROLET TRUCKS

haul more . . last longer . . cost less to run

Six-cylinder valve-in-head design . . . the most economical truck engine built

CHEVROLET Truck owners who keep cost records know that Chevrolet trucks are very economical. Their figures show that Chevrolet trucks can be operated with big loads at a surprisingly low cost, using a minimum of gasoline and oil, and seldom needing repairs. Each year, Chevrolet endeavors to improve the efficiency, dependability and economy of its trucks for the benefit of its owners. As a result, the 1934 line of Chevrolet trucks has already won high praise from experienced operators who vouch for its low operating cost and hauling capacity. See these big, strongly built trucks at your first opportunity. They offer you the proven economy of six-cylinder, overhead-valve design, increased in efficiency by numerous improvements. Their low prices enable you to replace obsolete units at once, with substantial savings on your current hauling expense.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G. M. A. C. terms. A General Motors Value

160,468 Miles . . . 1½-ton Chevrolet truck, in service eight years, hauling loads of paper averaging 2½ tons. Averaged 20 miles per gallon of gasoline on trips to Philadelphia under same load. One valve grind, new distributor points, new spark plugs only mechanical expense in 160,468 miles.

Joshua Rollman, Lititz, Penn.

115,000 Miles . . . Owner so pleased with 1932 Chevrolet truck that he bought a 1934 Chevrolet truck. The 1932 truck covered 115,000 miles in wholesale grocery hauling—average load 6 tons over mountain and desert country. Total operating cost, including depreciation, only 4.3 cents per mile. Gasoline mileage averaged 12 miles—no oil needed between changes at 1800-mile intervals.

C. B. Griffith, Ontario, Calif.

125,000 Miles . . . 1932 Chevrolet truck. Two valve grinds and one brake relining only repair expense in 125,000 miles. Averages 10 miles per gallon of gas, covering 8,000 miles per month with semi-trailer.

William Emmons, Los Angeles, Calif.

200,000 Miles . . . 144,218 Miles . . . 1931 Chevrolet 157-inch truck with dual wheels has covered 200,000 miles—still in first-class condition. Another Chevrolet 131-inch stake truck, purchased in 1930, has been driven 144,218 miles—operating costs about 50 per cent less than other makes of trucks in the same class and in the same service. These trucks will be replaced with 1934 Chevrolet trucks. Owner is standardizing on Chevrolets—plans to add two more to fleet soon.

Highway Express, Perry, N. Y.

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Member, Audit Bureau of Circulations

The Program Committee

The buying of excess gasoline in East Texas has now been going on for over a month. It was supposed to be conditioned upon a corresponding curtailment in "hot" oil production. Current reports indicate, however, that the "hot" oil output has greatly increased and is now around 80,000 barrels daily.

These reports are confirmed by the growing weakness in the gasoline market which they explain. If the purpose of the gasoline buying program was to obtain pledges to cease producing illegal oil they have evidently not been kept. On the contrary, the buying program appears to have been seized as an extra outlet for excess gasoline.

This development was predicted by cynical observers of the district when the buying program was launched. In the light of all the schemes and devices that had been invented in East Texas to cheat the law they could not imagine any pledge being kept if it was more profitable to break it.

So far the resourceful lawbreaker has been able to build a detour around every obstacle thrown in his way. The new Federal tax regulations of the United States Treasury Department which were so hopefully awaited to enmesh the "hot" oil producer have already been found in need of tightening East Texas was not long in finding loopholes in them.

Same with the reports which the Petroleum Administration thought would infallibly trip the offender. The forms sent out are already being revised to meet newly discovered difficulties.

So far as the hubbub about checking shipments of "topped oil" is concerned the effect seems to be the same as from the other proclamations of the Texas Railroad Commission. Railroads anxious for oil shipments quickly found the state regulation could not apply to interstate traffic to the joy of "hot" oil consignors. The affinity between railroad and "hot" oil shippers had long been suspected, sidings offering a convenient storage space in need.

Complacent or incompetent regulatory authorities and the co-operation of transportation agencies have helped make enforcement in East Texas a laughing stock.

The Federal administration has been fought or thwarted at every turn. It has been handicapped by litigation and by politics in Texas and in Congress. It is being handicapped also by the dilatory methods of governmental procedure. The routine of referring questions from Washington to the field or from the field to Washington, to the Department of Justice, to the Bureau of Mines, to this official and that and all the other circumlocution built up by traditional habit in the government service ties the enforcement agencies to the post while the nimbler lawbreaker romps all over the lot.

It has been so entangled in details that it has overlooked more vital points as in the matter of basing crude allowables upon gasoline consumption just pointed out by the resolution of the new Program Committee of the Planning and Coordination Committee.

The Oil and Gas Journal commented some time ago on the excess in crude allowables in view of the general situation. Excess crude is always a menace to the gasoline market since cheap crude is a constant temptation to increase crude runs.

Strict allocation of crude on the basis of gasoline consumption will be essential to any plan to extend the buying of distress gasoline throughout the country. But it will require more than official promulgation at Washington as the Program Committee recognizes.

The marketing practice of "trying to take business from each other" which Sir Henri Deterding remarks is more apparent in this country than in any other is going to be hard to eradicate short of some sort of cartel system.

Such a program of regulation of the industry by the industry, supported by whatever authority the government can give to it, may be the only way to secure stabilization. There has never been any doubt that, if the industry really determined to enforce stabilizing measures and was permitted to do so, it could deal with the anarchial few in short order. Perhaps we are coming to that if the program of the Program Committee is carried out.

A Contrast and a Question

A Tulsa executive of an oil company calls attention to an interesting contrast.

Observing that gasoline consumption in the first six months of this year equalled that in the same period of 1929 he compared the corresponding figures on production, demand and price of crude and gasoline.

He was astonished to find that crude production, plus imports, was some 65,000,000 barrels less in this year's period than in the first half of 1929; that crude runs to stills were 45,000,000 barrels less; that crude stocks were 90,000,000 barrels smaller; that gasoline production plus imports was 10,000,000 barrels less; that total demand for motor fuel was slightly greater; that gasoline stocks at refineries were nearly 7,000,000 barrels smaller, that the price of 36 gravity Oklahoma crude is now $1.00 against $1.45 a barrel in the first half of 1929, but that Chicago tank wagon gasoline price this year is only 10.3 cents a gallon whereas it was 16 cents in the same period of 1929.

Statistically the industry is in much better shape than in the 1929 period but contrast in prices does not show it. He asks: "Why?"

There was no East Texas in 1929. We had taken the measure of Seminole. Oklahoma City was being regulated to some extent. The gasoline chiseler was just beginning to develop the technique of his "hot" oil racket. It was not until East Texas offered him unlimited possibilities that the Chicago tank wagon market dropped to 11 cents, not so much higher than today.

The statistical contrast between the first half of 1929 and the same period of this year is incomplete without taking into account the vast volume of crude so easily available in East Texas. Hope of regulating that production increased the price of crude from a quarter to a dollar. Failure to curb that overproduction has provided cheap crude to illegal producers who have used it to make cheap gasoline. A million gallons of cheap gasoline a day is something we did not have to contend with in the first half of 1929.

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Railroad Commission Order Regarding East Texas Shipments Holds Group 3 Market's Interest

By T. F. SMILEY

Oklahoma (Group 3) market interest centered this week on developments growing out of the order issued by the Railroad Commission of Texas that railroads accept no oil products for shipment out of East Texas unless the person offering the shipment present a certified statement (a "tender" in transportation parlance), approved by the commission, authorizing transportation of such products, explaining how they were processed, giving the name, address and ownership of the refinery or topping plant from which they came and stating whether or not the crude from which they were derived was produced under the rules of the commission. Under the criminal code the penalty for false certification is not more than $10,000 fine or more than 10 years imprisonment or both.

Likely to Cause Temporary Uneasiness

There was general agreement that this order was likely to cause uneasiness. That "ten thousand or ten years" especially was calculated to give the hot oil operator pause. However, alarm soon gave way to a feeling that just as loopholes had been found in laws in the past they probably could be found, with the help of clever lawyers, in the future.

The railroads interpreted the order at first as applying to intrastate shipments only, but early this week they were making no distinction as between interstate and intrastate shipments.

Notwithstanding the common belief that the refined oil market would show at least temporary improvement as a result of the Texas Railroad Commission's order regarding tenders and the apparent rigid application of the order by the railroads, there was skepticism. Some observers, for instance, expressed doubt as to whether this zeal would continue after the next regular session of the state legislature has disposed of a proposed bill to take oil and gas out of the commission's jurisdiction and place them in the hands of a separate bureau.

Signs of the various obstructions and delays that may be expected before any concrete results can grow out of the commission's tender order are already visible. Suits directed against the order were started in two courts, but one of the cases later was withdrawn after the order had been amended to the satisfaction of F. W. Fischer, counsel for the Superior Oil Corp. and others.

It was reported Tuesday of this week that another injunction suit was being prepared.

Market Break Possible

It was the expressed opinion of marketers and jobbers that if an injunction should be granted restraining the Railroad Commission and the railroads from interfering with shipments of oil products because of alleged illegality in the production of the crude from which these products were made, there would be a sharp break in the market. If an injunction should be refused it was declared higher prices would prevail for a time.

On Tuesday of this week virtually no motor fuel was moving out of East Texas as a result of the embargoes observed by the railroads. Refiners refused to take orders for gasoline which they had no assurance they would be able to ship.

U. S. Motor low octane material was available in East Texas at 3⅛ cents until early this week when it became necessary for brokers and jobbers to look elsewhere for their needs. They were getting gasoline, according to reports, at 3¼ to 3⅜ cents. Some of it came from Oklahoma refineries and some from gasoline in transit that had been hurriedly shipped out of East Texas before the situation tightened up.

The "official" prices of gasoline in Group 3 territory, that is, the prices at which major refining companies are buying from independent East Texas refiners under government-sponsored contracts, were without material change. The spot market, as it has been for weeks, was below these prices.

Naturals Steady

Little change was observable in the natural gasoline market. The demand for 26-70 continued steady and there was said to be none of this material looking for buyers.

The uncertainties prevailing in the straightrun gasoline market were reflected in the stabilized grades of natural, although prices remained unchanged.

Kerosene was slow. Distillates were slightly stronger on account of coastwise buying. Neutrals, bright stocks and steam-refined stocks held the minor gains in firmness recorded last week. Wax, still weak, exhibited faint signs of the beginning of recovery, more numerous inquiries being reported.

Refined Oil Market Barometer

A nervous motor fuel market prevailed in many areas as a result of the situation in East Texas, which has been the pivotal point in the market. The order of the Texas Railroad Commission requiring tenders showing not only the precise classification of the product offered for shipment but the legality or illegality of the crude from which it was made resulted in refiners in that district suddenly refusing to accept orders for motor fuel in fear that they would not be able to obtain the tenders necessary to move the material. In other refined products seasonal influences were seen.

Mid-Continent—Gasoline prices stiffening as a result of inability to get material out of East Texas. Naturals steady.

East Coast—Gasoline tank car prices lower, reflecting weakness which was apparent for several weeks. Other products slow.

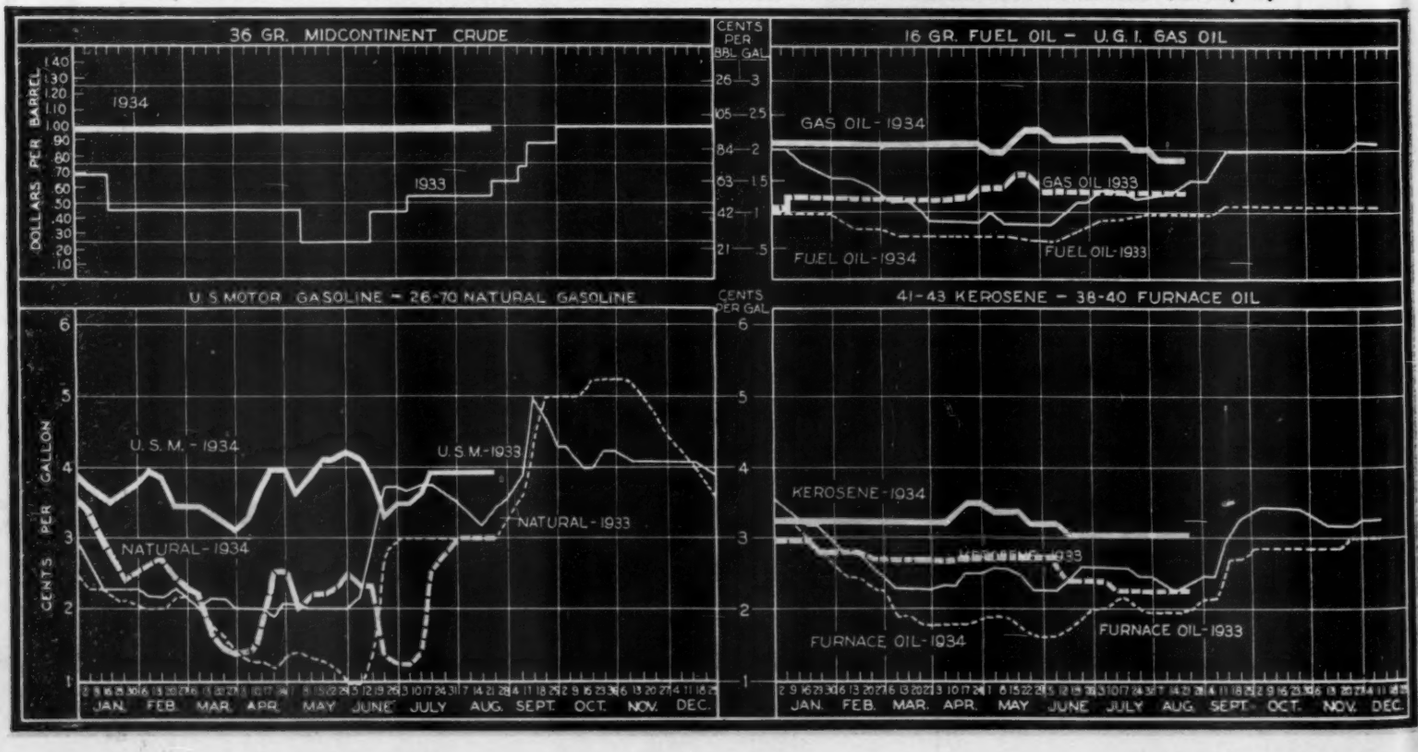
Gulf Coast—Refinery prices unchanged, but gasoline market uncertain owing to East Texas situation. Lubricants steady. Fuels fairly firm.

Pennsylvania—Bright stocks in sharp advance. Gasoline quiet. Trading slow.

California—Market firm, but sensitive and may reflect discharge of East Texas gasoline within next 15 days.

Chicago—Gasoline tone uncertain, with business slow. Most burning oils backward. Naphthas unchanged.

Representative Mid-Continent Quotations on Crude Oil and Refined Products Basis Oklahoma (Group 3)



Reflecting Weakness Already Apparent, Eastern Gasoline Prices Start Week at Lower Levels

By C. O. WILLSON
New York Bureau, The Oil and Gas Journal

NEW YORK, Aug. 20.—Reflecting a weakness which has been apparent since early July, gasoline tank car prices started a new week at levels from one-fourth to three-fourths cent per gallon lower than the schedules in effect at Eastern and Atlantic Seaboard points a week ago.

An unusual price situation existed today in that the tank car market on the various grades of gasoline basis Bayonne, N. J., and New York Harbor, for shipment to New York and New England, was one-fourth to one-half cent less than for New Jersey and other points. Major companies met the Socony-Vacuum prices in New York and New England, but in most cases were maintaining the quotations in effect for several weeks at other Atlantic Seaboard and inland distributing points.

Representative prices in the New York Harbor area for shipment to New York were 6½ cents for branded ethylized grades, 6 to 6¼ for 65 octane and above, 5¾ to 6 cents for 60 to 64.09 octane and 5½ to 5¾ cents for low octane material. The posted schedules of most of the major companies for shipment to New Jersey and other points were one-fourth to one-half cent above these prices.

The Socony-Vacuum Oil Co., Inc., among the major companies led in making reductions when it announced on Friday, August 17, that tank car prices on all the four grades of gasoline it offers the jobbing trade would be reduced one-half cent per gallon in New York State and New England except western New York. The reductions were promptly met by other major refiners selling to the jobbing trade in that territory.

Declines Not a Surprise

The declines did not come as a surprise to the trade which has felt for some time that the scattered price reductions which have become effective over the last month were certain to bring a general decline. At many of the points including several large cities in the Socony-Vacuum territory, tank car prices on gasoline have been from one-half to 1 cent or more per gallon under that company's posted tank car quotations. The company last year endeavored to establish a price structure at its distributing points with certain fixed differentals between the delivered tank car prices and the tank wagon and service station prices. At many points this differential as in the case of the Standard of New Jersey territory, was 6.5 cents per gallon for the regular grade gasoline. Certain fixed margins for dealers were also established. It was explained at the time this plan was adopted that the base tank car prices would be largely determined by the going market at the Gulf Coast in coastwise tanker shipments.

This latter market, as explained in these columns previously, has been weak most of the summer with cargo shipments delivered to East Coast points at prices which permitted the shippers to sell the jobbing trade at prices under the quotations which most of the major companies were endeavoring to maintain at their refineries and terminals. The price reductions of the last week by these companies are a recognition of this condition and an attempt to meet prices established by conditions which reflect the weakness of the Mid-Continent markets where distress gasoline continues to be a factor in day-to-day sales.

Whether the reductions of the last week will remedy conditions remains to be seen. There are those in the market who are predicting an additional reduction this week. It is claimed that unless something unforeseen develops there are large quantities of gasoline to be dumped on this market from the Gulf Coast and the sellers probably will be willing to take whatever price concessions are necessary to secure outlets. It is contended that it is useless for both large and smaller sellers to further ignore this situation and the assumption is that these companies will at least meet competition wherever it appears in their tank car, tank wagon and service station business and when considered necessary, will make general reductions.

Buying Agency

It was widely reported in the trade the latter part of last week that a new buying program under the direction of the Planning and Coordination Committee would be started immediately to include not only East Texas but excess gasoline wherever it becomes available with special attention to the Gulf Coast because of its direct relationship to domestic markets along the Atlantic Seaboard. Such a program, it was said, would be under way before the end of this week.

While this wide-scale buying may materialize at this time in an effort to ward off a threat which could easily develop into a general collapse of the oil price structure including crude oil, representative opinions here indicate that something more will have to be done to bring about any permanent strength in the market. It is no exaggeration to state that certain factors in the business are somewhat "soured" as to the accomplishments of the buying program so far and feel that further efforts along that line are futile until some adequate action is taken to end the overproduction of crude oil and refinery products especially that part of the excess brought about through "hot oil" operations. As explained by one company executive the gasoline buying setup supported by a few large refiners is not a cure for conditions in the industry and can only serve in a supplementary capacity to aid in the general program to stabilize prices through sound operating conditions in the producing and refining branches. Buying gasoline in the face of continued overproduction at best is only "swapping dollars," he says, and probably does more harm than good.

Another marketing executive contends that the uncertainty of the past few weeks is retarding buying both here and abroad, buyers sensing the weakness and expecting lower prices. He also feels that buying of distress gasoline through a buying agency accomplishes nothing unless the present situation is reversed and buyers can enter the market with confidence that prices will not be lower a week or six months from now. With these conditions in mind, many of the trade in this territory who are trying to gauge the fall and winter markets are paying more attention to the enforcement of the Government's allocations for crude oil production and refinery operations that they are to any plans for extending the scope of activities to buy excess gasoline.

Other Products Slow

No special activity was apparent in any of the refinery products in this market. With the consuming season under way starting September 1 the movement of furnace oils from refineries to bulk stations is increasing. This movement is largely on contract, however, and spot buying is inactive.

Kerosene Prices Lower

The kerosene market is lower with plenty of material available at 5 cents basis New York. It is predicted by some that kerosene consumption will shortly improve and open market buying will become more active. Lack of activity in the export market over the past month has resulted in more material being offered to the domestic trade.

No important price changes are reported in the heavier fuels. There has been some improvement in the demand for low gravity gas oils coming largely from the gas manufacturers. This product is also used as a fuel for apartment houses and other large buildings. The going market is 4½ cents in tank car lots. Buyers are said to be attempting to secure concessions of one-fourth to one-half cent off this price. Diesel fuel is selling at the same price in tank car lots with a price range up to 5 cents. In barrels the price is $1.95. The Bunker C market continues at $1.30 per barrel.

Cylinder Stocks Advance

After a steady decline of several weeks most of the manufacturers of Pennsylvania steam refined stocks and bright stocks advanced their quotations last week from 1 to 2 cents per gallon. Representative quotations were 18 to 18½ cents per gallon in barrels for 60 S.R. unfiltered; 22 to 22½ cents for 600 flash, and 27 to 27½ cents for No. 8 color bright stock. Those manufacturing western stocks also advanced their prices. It was hoped that these advances could be maintained. Crude scale wax continues weak with sales as low as 2.6 cents per pound reported for yellow scale over the past week. Refined grades were unchanged.

NEW BROOKLYN TERMINAL

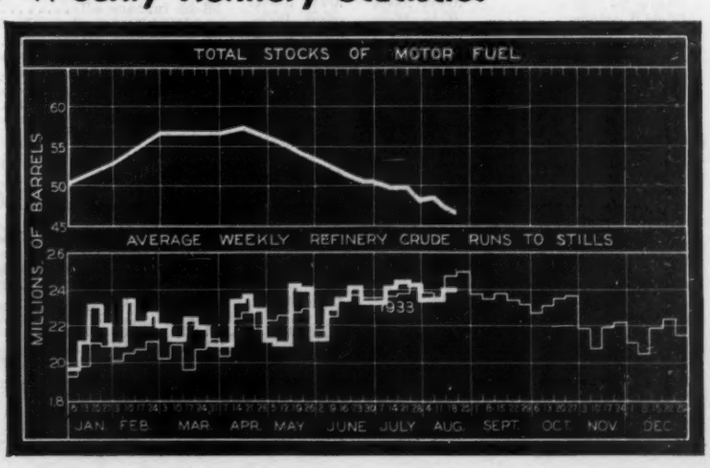
NEW YORK, Aug. 18.—The Argus Gas & Oil Sales Co., Inc., is preparing to build a large bulk storage terminal in Brooklyn. The site is located on Greenpoint Ave., running to the bulkhead pier on Newtown Creek. The terminal will cost approximately $600,000 and will have storage capacity for 1,500,000 gallons of petroleum products.

American Petroleum Institute Weekly Refinery Statistics

Week Ending August 18, 1934

	Capacity reporting per cent	Daily crude runs (bbls.)	Finished motor fuel (bbls.)	Gas oil and fuel oil (bbls.)
East Coast	100.0	461,000	14,544,000	12,165,000
Appalachian	93.3	100,000	1,521,000	1,264,000
Indiana, Illinois, Kentucky	94.6	354,000	7,007,000	4,400,000
Oklahoma, Kansas, Missouri	83.7	239,000	4,555,000	3,695,000
Inland Texas	47.6	99,000	1,225,000	1,603,000
Texas Gulf	97.5	528,000	3,298,000	9,349,000
Louisiana Gulf	96.4	112,000	1,272,000	2,389,000
North Louisiana and Arkansas	83.7	53,000	331,000	607,000
Rocky Mountain	66.7	50,000	745,000	623,000
California	96.9	426,000	12,056,000	76,696,000
Total United States	89.7	2,422,000	46,554,000	113,091,000

Note: Finished motor stocks shown in graph and in table include those at refineries, at bulk terminals and in pipe lines, but do not include 5,000,000 to 7,000,000 bbls. of unfinished gasoline which could be reprocessed quickly.



REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement except as otherwise noted

Quotations are exclusive of the Federal tax of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasolines

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
U. S. Motor grades:				
Below 63 octane	.03⅞	.04⅛	.03⅞	.04⅛
63-70 octane	.04½	.04⅝	.04½	.04⅝
60-62 400 grades:				
Below 63 octane	.03⅞	.04⅛	.03⅞	.04⅛
63-70 octane	.04½	.04¾	.04½	.04¾
64-66 375	.04⅛	.04⅝	.04⅛	.04⅝
68-70 360	.04⅝	.04½	.04⅝	.04½
NORTH TEXAS—				
U. S. Motor grades:				
Below 63 octane	.03¾	.03⅞	.03¾	.03⅞
63-70 octane	.04⅝	.04½	.04⅝	.04½
60-62 400	.03⅞	.04	.03⅞	.04
64-66 375	.04		.04	
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 63 octane	.04¼		.04¼	
63-70 octane	.05		.05	
60-62 400	.04¼	.04⅝	.04¼	.04⅝
68-70 360	.04⅝	.04⅝	.04⅝	.04⅝
ARKANSAS (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 63 octane	.04¼		.04¼	
63-70 octane	.05		.05	
CHICAGO (based on Oklahoma Group 3)—				
U. S. Motor grades:				
Below 63 octane	.03¾	.04	.03¾	.04
63-70 octane	.04½	.04¾	.04½	.04¾
60-62 400	.03¾	.04	.03¾	.04
64-66 375	.04	.04¼	.04¼	.04¼
68-70 360	.04¼	.04½	.04⅝	.04½
Aviation fighting grade	.05	.05¼	.05⅛	.05¼
PENNSYLVANIA (inland refineries)—				
58-60 U. S. Motor:				
Below 60 octane	.05⅝	.05¾	.05¾	.06
60-64.9 octane	.06¼	.06⅝	.06¼	.06⅝
65-70 octane	.06⅞	.07	.06⅞	.07
68-70 350	.06½	.06⅝	.06½	.06⅝
CALIFORNIA (domestic movement)—				
54-58 U. S. Motor	.07	.08	.07	.08
58-60 400	.08	.09	.08	.09
EAST COAST—				
U. S. Motor, below 60 octane:				
*New York	.05½	.05¾	.06	.06¼
Baltimore	.05¾	.06	.06	.06¼
U. S. Motor, 60-64 octane:				
*New York (Bayonne)	.05¾	.06	.06¼	.06½
Philadelphia	.06	.06¼	.06¼	.06½
Boston	.05¾	.0620	.06¼	.0670
Baltimore	.06	.06¼	.06¼	.06½
Charleston, S. C.	.06	.06¼	.06¼	.06½
U. S. Motor, 65 and above:				
*New York (Bayonne)	.06	.06¼	.06½	.06¾
Philadelphia	.06¼	.06½	.06½	.06¾
Boston	.06	.0640	.0650	.0690
Baltimore	.06¼	.06½	.06¼	.06¾
Charleston, S. C.	.06¼	.06½	.06½	.06¾

*All grades of gasoline one-fourth cent less for small barge shipments.

GULF COAST (domestic)—				
U. S. Motor:				
Below 60 octane	.04⅞	.05⅛	.04⅞	.05⅛
60-64.9 octane	.05¼	.05⅝	.05¼	.05⅝
65 octane and higher	.05⅝	.05⅝	.05⅝	.05⅝

Naphthas

	Aug. 21		Aug. 14	
PENNSYLVANIA (inland refineries)—				
50-52 450 (blending)	.05⅜	.05½	.05⅜	.05½
52-54 450 (blending)	.05⅝	.05½	.05⅝	.05½
54-56 450 (blending)	.05⅝	.05½	.05⅝	.05½
CHICAGO (based on Oklahoma Group 3)—				
50-52 450 (blending)	.03¾	.04	.03¾	.04
Cleaners' naphtha, 56-58 gr., 200 i.b.p.-320 e.p.	.06¾	.07	.06¾	.07
Lacquer diluent, 180 i.b.p.-250 e.p.	.07¾	.08	.07¾	.08
Lacquer diluent, 140 i.b.p.-200 e.p.	.08¾	.09	.08¾	.09
Rubber solvent, 68-70 gr., 100 i.b.p.-300 e.p.	.06¾	.07	.06¾	.07
Stoddard solvent, 300 i.b.p.-410 e.p., over 83° flash	.06¼	.06½	.06¼	.06½
Pet. thinner, 290-300 i.b.p.-415 e.p., over 83° flash	.06¼	.06½	.06¼	.06½
V.M.&P. naphtha, 56-58 gr., 190-200 i.b.p.-330 e.p.	.06¾	.07	.06¾	.07
Petroleum spirits	.05¾	.06	.05¾	.06

Natural Gasolines

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
Grade 26-70	.03		.03	
Grade 18-55	.03½		.03½	
Low vapor pressure grades:				
14 lb. v.p. (max.)	.03¾		.03¾	
11 lb. v.p. (max.)	.04⅛	.04¼	.04⅛	.04¼
NORTH TEXAS—				
Grade 26-70	.03		.03	
Grade 18-55	.03½		.03½	
Low vapor pressure grades:				
14 lb. v.p. (max.)	.03¾		.03¾	
11 lb. v.p. (max.)	.04	.04¼	.04	.04¼
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
Grade 26-70	.03⅜		.03⅜	
CALIFORNIA—				
75-85 375	.06½	.06¾	.06½	.06¾

Kerosenes

(All kerosenes water white)

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
41-43	.03¼	.03¼	.03½	.03¼
42-44	.03¼	.03½	.03¼	.03½
NORTH TEXAS—				
40-41	.02⅞	.03⅛	.02⅞	.03⅛
41-43	.03	.03¼	.03	.03¼
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
41-43	.03⅜		.03⅜	
ARKANSAS (Ark., N. La. & Miss. del.)—				
41-43	.03⅜	.03½	.03⅜	.03½
PENNSYLVANIA (inland refineries)—				
45	.04¼	.04⅜	.04¼	.04⅜
46	.04⅜	.04½	.04⅜	.04½
47	.04½	.04⅝	.04½	.04⅝
CHICAGO (based on Oklahoma Group 3)—				
41-43	.03¼	.03¼	.03½	.03¼
42-44	.03⅜	.03½	.03⅜	.03½
CALIFORNIA (Pacific Coast consumption)—				
38-40 high burning test	.04¾	.05¼	.04¾	.05¼
NEW YORK (Bayonne, N. J.)—				
41-43	.05	.05¼	.05¼	.05½
GULF COAST (domestic)—				
41-43	.04½	.04⅝	.04½	.04⅝

Petroleum Coke

(Prices per ton f.o.b. refineries in Chicago area)
(Refineries will absorb freight to 80 cents a ton)

	Aug. 21		Aug. 14	
Breeze (screenings)	5.00		5.00	
Pile run	5.00		5.00	
Lump and egg	7.00	8.00	7.00	8.00
Direct from still	6.00		6.00	

Furnace Oils and Tractor Fuels

(Zero cold test under 190° flash and good odor)

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
32-36 straw	.02⅛	.02⅝	.02½	.02⅝
36-38 straw	.02½	.02⅝	.02½	.02⅝
38-40 straw	.02⅝	.02½	.02⅝	.02½
38-40 prime white	.02⅝	.02¾	.02⅝	.02¾
NORTH TEXAS—				
38-40 straw	.02⅝	.02¾	.02⅝	.02¾
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
36-40 furnace oil	.02⅞	.03	.02⅞	.03
ARKANSAS (Ark., N. La. & Miss. del.)—				
32-36 furnace oil	.02⅝	.02¾	.02⅝	.02¾
CHICAGO (based on Oklahoma Group 3)—				
32-36 straw	.02⅜	.02½	.02⅜	.03½
38-40 straw	.02⅝	.02½	.02⅝	.02½
38-40 prime white	.02½	.02⅝	.02½	.02⅝
NEW YORK (Bayonne, N. J.)—				
36-40 (No. 1 grade)	.05¼	.05½	.05¼	.05½
32-36 (No. 2 grade)	.04¾	.05	.04¾	.05
21 industrial (No. 4 grade)	.04½	.05	.04½	.05

Gas Oil, Diesel Oil and Fuel Oil

(Gas oil per gallon; Diesel and fuel oils per barrel)

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
32-36 gas oil cracking stocks	.02	.02⅛	.02	.02⅛
U.G.I. gas oil	.01⅞	.02	.01⅞	.02
32-36, zero to 15 gas oil	.02⅝	.02½	.02⅝	.02½
28-30, No. 3 burner oil	.95	1.00	.95	1.00
26-30, zero to 10 fuel oil	.85	.95	.85	.95
24-26 fuel oil	.75	.80	.75	.80
20-22 fuel oil	.67½	.70	.67½	.70
Below 16 fuel oil	.62½	.65	.62½	.65
NORTH TEXAS—				
32-36 gas oil, industrial	.01⅞	.02	.01⅞	.02
22-26 fuel oil	.67½	.70	.67½	.70
Below 20 fuel oil	.57½	.62½	.57½	.62½
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
30-32 gas oil, zero	.02½	.02⅝	.02½	.02⅝
14-16 fuel oil	.70	.75	.70	.75
ARKANSAS (Ark., N. La. & Miss. del.)—				
30-32 gas oil, zero	.02½	.02⅝	.02½	.02⅝
32-36 gas oil	.02⅝	.02½	.02⅝	.02½
14-16 fuel oil	.70	.75	.70	.75
CHICAGO (based on Oklahoma Group 3)—				
32-36 gas oil, industrial	.02	.02⅛	.02	.02⅛
28-30 zero to 10, fuel oil	.97½	1.02½	.97½	1.00
26-28 zero to 10, fuel oil	.87½	.92½	.87½	.90
22-26 zero to 10, fuel oil	.77½	.82½	.77½	.80
18-22 zero to 10, fuel oil	.62½	.67½	.62½	.67½
Below 18 fuel	.55	.60	.55	.60

Note: Fuel oils of more than 40 cold test generally 5 to 15 cents per barrel less in all these areas.

PENNSYLVANIA (inland refineries)—				
36-40	.03⅞	.04	.03⅞	.04
CALIFORNIA—				
Los Angeles:				
30-34 gas oil per bbl.	1.10	1.26	1.10	1.26
27 plus Diesel	1.05	1.20	1.05	1.20
27 plus Diesel (bunkers)	1.13	1.20	1.13	1.20
12-16 (bunker at tidewater)	.82	.85	.82	.85
10-16 (cargo lots)	.66	.75	.66	.75
12-17 (tank cars)	.60	.80	.60	.80
San Joaquin Valley:				
10-18 (tank cars)	.60	.70	.60	.70
San Francisco:				
27 plus Diesel per bbl.	1.15	1.25	1.15	1.25
27 plus Diesel (bunkers)	1.19		1.19	
10-16 (bunkers)	.89		.89	
GULF COAST—				
28-30 gas oil	.03½	.03¾	.03½	.03¾
28-30 Diesel (bunkers)	1.80		1.80	
Bunker C (bulk cargoes)	.95	1.00	.95	1.00
Bunker C (bunkers)	1.05	1.10	1.05	1.10
NEW YORK (Bayonne, N. J.)—				
27 plus, gas oil	.04½	.05	.04½	.05
28-30 Diesel (lighterage 6½ cents per bbl.)	1.95		1.95	
*Bunker C (to ocean-going ships in N. Y. harbor)	1.30		1.30	

*Lighterage charge 5 cents per barrel additional.

Neutral Oils

(Vis. at 100° F. except Pennsylvania, and color N.P.A.)

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
Zero to 10 Cold Test:				
150-3	.10		.10	
180-3	.11⅛		.11⅛	
180-4	.10⅝		.10⅝	
200-3	.11⅝		.11⅝	
200-4	.11⅛		.11⅛	
240-3	.13⅝		.13⅝	
240-4	.13¼		.13¼	
280-3	.14¾		.14¾	
280-4	.14		.14	
300-3½	.15⅛		.15⅛	
400-4	.17⅛		.17⅛	
100-2 paraffin oil	.05¾		.05¾	
15-30 Cold Test:				
200-3	.10¾		.10¾	
200-4	.10¼		.10¼	
240-3	.12¾		.12¾	
240-4	.12¼		.12¼	
280-3	.13¾		.13¾	
280-4	.13		.13	
GULF COAST—				
Pale Oils:				
200-3	.07½		.07½	
300-3	.08	.08¼	.08	.08¼
500-3½	.09	.09¼	.09	.09¼
750-3½	.09½	.09¾	.09½	.09¾
1,200-3½	.10	.10¼	.10	.10¼
2,000-4	.10¼	.10½	.10¼	.10½
Red Oils:				
200-5-6	.06½		.06½	
300-5-6	.07	.07½	.07	.07¾
500-5-6	.08	.08¼	.08	.08¾
750	.08½	.08¾	.08½	.08¾
1,200-5-6	.09	.09¼	.09	.09¼
CALIFORNIA—				
Pale Oils:				
100-2½-3	.17½	.20½	.17½	.20½
200-2½-3	.17½	.20½	.17½	.20½
300-3-3½	.17½	.20½	.17½	.20½
350-3-4	.17½	.20½	.17½	.20½
400-3-4	.17½	.20½	.17½	.20½
450-3-4	.17½	.20½	.17½	.20½
550-3-4	.17½	.20½	.17½	.20½
600-3-4	.17½	.20½	.17½	.20½
Red Oils:				
200-4-5	.17½	.20½	.17½	.20½
300-5-6	.17½	.20½	.17½	.20½
350-5-6	.17½	.20½	.17½	.20½
400-5-6	.17½	.20½	.17½	.20½

450-5-6	.17½	.20½	.17½	.20½
500-5-6	.17½	.20½	.17½	.20½
600-5-6½	.17½	.20½	.17½	.20½
700-6½ plus	.17½	.20½	.17½	.20½
750-6½ plus	.17½	.20½	.17½	.20½
900-6½ plus	.17½	.20½	.17½	.20½
PENNSYLVANIA—				
150 vis. at 70° F., 3 color;	400-405 flash:			
Zero pour test	.23	.23½	.23	.23½
10 pour test	.22	.22½	.22	.22½
15 pour test	.21½	.22	.21½	.22
25 pour test	.21	.21½	.21	.21½
180 vis. at 70° F., 3 color:				
25 pour test	.24½	.25	.24½	.25
200 vis. at 70° F., 3 color:				
Zero pour test	.29½	.30	.29½	.30
10 pour test	.28½	.29	.28½	.29
15 pour test	.28	.28½	.28	.28½
25 pour test	.27½	.28	.27½	.28

Bright and Steam Refined Stocks

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
Bright Stocks:				
190-200 D	.20		.20	
150-160 D, 0-10	.17		.17	
150-160 D, 10-25	.16½		.16½	
150-160 25-40	.16		.16	
150-160 E	.16		.16	
Steam refined:				
630 light green (treated)	.13		.13	
600 light green (untreated)	.06	.08	.06	.08
600 dark green (untreated)	.04½	.07	.04½	.07
PENNSYLVANIA—				
Bright Stocks (Pennsylvania grade, No. 8 color, 145-50 at 210; 540-550 flash):				
10 pour test	.21½	.22	.19½	
15 pour test	.21	.21½	.19	
20 pour test	.20½	.21	.18½	
25 pour test	.20	.20½	.18	
Steam refined:				
600	.11½	.12	.10	.10½
650	.14	.14½	.12½	.13
600 Pennsylvania flash	.15	.15½	.13½	.14
600 Warren E filtered	.15	.15½	.13½	.14

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—	Aug. 21		Aug. 14	
124-126 white crude scale	.03¼	.03⅜	.03¼	.03⅜
PENNSYLVANIA—				
122-124	.0290	.0300	.0290	.0300
124-126	.0295	.0305	.0295	.0305
NEW YORK HARBOR—				
Wax (a.m.p.) in bags fully refined:				
120-122	.0420	.0430	.0420	.0430
123-125	.0440	.0460	.0440	.0460
125-127	.0445	.0470	.0445	.0470
128-130	.0480	.0495	.0480	.0495
130-132	.05	.0510	.05	.0510
133-135	.0545	.0570	.0545	.0570
135-137	.0570	.0595	.0570	.0595
124-126 crude scale	.0260	.0280	.0287	.0300
Petrolatum in barrels in carload lots:				
Dark green	.01⅞		.01⅞	
Amber	.02⅞	.03	.02⅞	.03
Extra amber	.03½	.03¼	.03¼	.03¼
Lily white	.06¾	.06⅞	.06¾	.06⅞
Snow white	.07¾	.07⅞	.07¾	.07⅞
Cream	.05⅝	.05¾	.05⅝	.05¾
CHICAGO (f.o.b. switching district)*—				
122-124 wax	.0490	.0500	.0490	.0500
125-127 wax	.0515	.0525	.0515	.0525
127-129 wax	.0530	.0540	.0530	.0540
130-132 wax	.0590	.0600	.0590	.0600
132-134 wax	.0615	.0625	.0615	.0625

*Cents per pound on carlot orders in burlap bags of 225 lbs. approx. Add 3° F. a.m.p.

Export Prices

GASOLINE

GULF COAST—	Aug. 21		Aug. 14	
U. S. Motor	.04⅛	.04¼	.04⅛	.04¼
60-62 400	.04¼		.04¼	
61-63 390	.04⅜	.04½	.04⅜	.04½
64-66 375	.04½	.04⅝	.04½	.04⅝
LOS ANGELES, CALIF.—				
U. S. Motor grades:				
53-55 octane	.04	.04¼	.04	.04¼
55-65 octane	.04¼	.04½	.04¼	.04½
65-67 octane	.04½	.04¾	.04½	.04¾
67-69 octane	.04¾	.05	.04¾	.05
Above 69 octane	.05	.05¼	.05	.05¼
58-60 400 endpoint	.04¾	.05½	.04¾	.05½

KEROSENE

GULF COAST—				
41-43 prime white	.04	.04½	.04	.04½
41-43 water white	.04⅛	.04¼	.04⅛	.04¼
41 water white	.04¼	.04⅜	.04¼	.04⅜
LOS ANGELES, CALIF.—				
41-43 water white	.04¼	.04¾	.04¼	.04¾

LUBRICANTS

NEW YORK (f.a.s. in bbls.)—				
Cylinder Stocks:				
600 Warren E	.21½	.22	.22	.22½
600 S.R. unfiltered	.18	.18½	.17	.17½
650 S.R. unfiltered	.20½	.21	.20	.20½
600 flash S.R.	.22	.22½	.21½	
630 flash S.R.	.27	.27½	.26	.26½
Bright Stocks:				
8 color	.27	.27½	.26	.26½
6½ plus color, in dilution	.26	.26½	.25	.25½

NEUTRAL OILS

200-3 color	.34	.34½	.33½	.34
150-3 color	.28		.28	.28½

PARAFFIN WAX (Fully Refined)

NEW YORK (prices per pound)—				
120-122 a.m.p.	.0405	.0425	.0405	.0425
123-125 a.m.p.	.0435	.0455	.0435	.0455
125-127 a.m.p.	.0440	.0465	.0440	.0465
128-130 a.m.p.	.04¾	.0490	.04¾	.0490
130-132 a.m.p.	.0495	.0505	.0495	.0505
133-135 a.m.p.	.0540	.0565	.0540	.0565
135-137 a.m.p.	.0565	.0590	.0565	.0590

Crude Oil Gravity Table

Degrees gravity—	Oklahoma and Kansas 1	North Texas, Central Texas and East Central Texas 2	North Louisiana and Arkansas 3	Gray County, Texas 4	Carson, Hutchinson and Moore Counties, Texas 5	Conroe, Texas 6	Salt Creek, Wyo. 7	Gulf Coast, Texas, and Louisiana 8	Gulf Coast, Texas, and Louisiana 9	Cotton Valley, Louisiana 10
Below 20	....	....	....	....	....	....	....	$.82	$.82	....
20-20.9	....	....	....	....	....	....	....	.84	.84	....
21-21.9	....	....	....	....	....	....	....	.86	.86	....
22-22.9	....	....	....	....	....	....	....	.88	.88	....
23-23.9	....	....	....	....	....	....	....	.90	.90	....
24-24.9	....	....	....	....	....	....	....	.92	.92	....
Below 25	*$.76	....	....	....	....	....	....	....	....	$.70
25-25.9	*.76	....	....	....	....	....	....	.94	.94	.72
26-26.9	*.80	....	....	....	....	....	....	.96	.96	.74
27-27.9	*.82	....	....	....	....	....	....	.98	.98	.76
28-28.9	*.84	....	....	....	....	....	....	1.00	1.00	.78
Below 29	.84	$.79	$.79	....	....	....	$.84	....	....	....
29-29.9	.86	.81	.81	....	....	....	.86	1.02	1.02	.80
30-30.9	.88	.83	.83	....	....	....	.88	1.04	1.04	.82
31-31.9	.90	.85	.85	....	....	....	.90	1.06	1.05	.84
32-32.9	.92	.87	.87	....	....	....	.92	1.08	1.06	.86
33-33.9	.94	.89	.89	....	....	....	.94	1.10	1.07	.88
34-34.9	.96	.91	.91	....	....	....	.96	1.12	1.08	.90
Below 35	....	....	....	$.79	$.69	....	....	....	....	....
35-35.9	.98	.93	.93	.81	.71	$1.09	.98	1.12	1.09	.92
36-36.9	1.00	.95	.95	.83	.73	1.11	1.00	1.12	1.10	.94
37-37.9	1.02	.97	.97	.85	.75	1.13	1.02	1.12	1.11	.96
38-38.9	1.04	.99	.99	.87	.77	1.15	1.04	1.12	1.12	.98
39-39.9	1.06	1.01	1.01	.89	.79	1.17	1.06	1.12	1.13	1.00
40 and over	1.08	1.03	1.03	.91	.81	1.19	1.08	1.12	1.14	1.02

Note—Effective June 1, 1934, Texas Co. purchases Texas Panhandle crude on a sweet crude and sour crude basis. Panhandle sweet crude is paid for on a basis of the Gray County prices posted above, and Panhandle sour crude is paid for on a basis of Carson and Hutchinson County prices posted above.

*The following companies purchasing crude oil in Kansas or Oklahoma, or both, begin their price schedule: Below 25°, 76 cents; 25-25.9°, 78 cents, with 2 cents added for each degree upward to 40 and over at $1.08; Carter Oil Co., Magnolia Petroleum Co., Pure Oil Co., Rock Island Refining Co., Shell Petroleum Corp., Sinclair Prairie Oil Marketing Co., Skelly Oil Co., and Wilcox Oil & Gas Co. All others begin their schedules at below 29°, 84 cents, excepting Phillips Oil Co., which begins with below 31° at 88 cents.

Column 1.—Effective September 29, Texas Co. in Oklahoma; Stanolind Crude Oil Purchasing Co. in Kansas and Oklahoma; Anderson & Prichard, Inc., in Oklahoma; Bell Oil & Gas Co. in Oklahoma; Carter Oil Co. in Oklahoma and Kansas; Deep Rock Oil Co. in Oklahoma; Derby Oil Co. in Kansas; Globe Refining Co. in Oklahoma; Golden Rule Refining Co. in Kansas; Gypsy Oil Co. in Oklahoma and Kansas; Kanotex Refining Co. in Kansas; Magnolia Petroleum Co. in Oklahoma; Mid-Continent Petroleum Corp. in Oklahoma; National Refining Co. in Kansas and Oklahoma; Shell Petroleum Corp. in Kansas and Oklahoma; Sinclair Prairie Oil Marketing Co. in Kansas and Oklahoma; Texas Co. in Oklahoma; Tide Water Oil Co. in Oklahoma; Vickers Refining Co. in Kansas; Continental Oil Co. in Kansas and Oklahoma; Empire Pipe Line Co. in Oklahoma and Kansas; Phillips Oil Co. in Kansas and Oklahoma; Pure Oil Co. in Oklahoma; Skelly Oil Co. in Kansas. Effective September 29, by White Eagle Oil Corp. in Kansas; Oct. 1 by Barnsdall Refineries, Inc., in Oklahoma.

Column 2.—Effective September 29, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Sinclair Prairie Oil Marketing Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Bell Oil & Gas Co., Continental Oil Co. Effective September 29, in the Van Peol, Van Zandt County, Pure Oil Co. posted below 29°, 84 cents, with 2 cents added for each degree up to 40 and over at $1.08.

Column 3.—Effective September 29, by Texas Co., Magnolia Petroleum Co., Gulf Refining Co. Effective December 22, Stanolind Oil & Gas Co. in Pine Island, Louisiana, and Marion County, Texas, posted below 29°, 79 cents, with 2 cents added for each degree up to 40 and over at $1.03. Effective March 17, 1934, by Standard Oil Co. of Louisiana and Louisiana Oil Refining Co. Starting with below 25° 71 cents, adding 2 cents for each degree upward to 40 and over at $1.03.

Column 4.—Effective September 29, by Texas Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Sinclair Prairie Oil Marketing Co., and H. F. Wilcox Oil & Gas Co. On same day Phillips Oil Co. posted below 31°, 71 cents, with 2 cents added for each degree up to 40 and over at 91 cents. Effective June 1, 1934, Texas Co. (see note above).

Column 5.—Effective September 29, by Texas Co., Humble Oil & Refining Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Wilcox Oil & Gas Co., Continental Oil Co. On same day, Phillips Oil Co. posted below 31°, 61 cents, with 2 cents added for each degree upward to 40 and over at 81 cents. Effective June 1, 1934, Texas Co. (see note above).

Column 6.—Effective September 29, by Humble Oil & Refining Co. and Tide Water Oil Co. and on September 30, by Texas Co., which on September 29 had posted a schedule of $1.07 to $1.12 with a 1-cent spread on each degree.

Column 7.—Effective September 29, by Stanolind Oil & Gas Co.

Column 8.—Effective September 29, by Humble Oil & Refining Co., Gulf Pipe Line Co., Shell Petroleum Corp., Pure Oil Co., Sinclair Prairie Oil Marketing Co. On October 2, Magnolia Petroleum Co. posted Lockport, Louisiana; 30-30.9°, 84 cents with 2 cents added for each degree upward to 34 and over at $1.12, and in Cameron Meadows and Iowa, Louisiana; Below 29°, 72 cents with 2 cents added for each degree up to 34 and over at $1.02. These prices were 2 cents higher on each degree than Magnolia prices posted on September 29. Effective September 29, Shell Petroleum Corp. posted in Iowa, Louisiana, district: Below 28° 70 cents, with 2 cents added for each degree upward to 34° and over at $1; and in Black Bayou and White Castle, Louisiana: Below 20°, 80 cents, with 2 cents added for each degree upward to 34° and over at $1.10.

Column 9.—Effective September 30, Texas Co. (On September 29, Texas Co. had posted a schedule of 2 cents on each degree, but changed it on September 30).

Column 10.—Effective September 29, by Louisiana Oil Refining Co.

(California Crude Oil Prices on Page R-331)

Crude Oil Prices

Oklahoma, Kansas, North Central and East Central Texas

East Texas	$1.00
Stratman, Kans. (Sept. 29, 1933)	1.03
Corsicana (heavy) (June 17, 1933)*	.80
Other fields	(See gravity table)

Note—In East Texas, effective September 29, 1933, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Shell Petroleum Corp., Gulf Pipe Line Co., Tide Water Oil Co., Sinclair Prairie Oil Marketing Co., Magnolia Petroleum Co., Sun Oil Co., Panola Pipe Line Co., and Empire Oil & Refining Co.

*Magnolia Petroleum Co.

West Texas

Crane, Upton, Crockett, Howard Glasscock, Mitchell (Sept. 29, 1933)	$.70
Ector, Winkler and Pecos Counties and Lea County, New Mexico (Sept. 29, 1933)	.75
Pecos County, Yates shallow pool (Sept. 29, 1933)*	.65
Jones and Fisher Counties	*See gravity table

Note—Effective September 29, 1933, by Humble Oil & Refining Co., Texas Co., Gulf Pipe Line Co., Shell Petroleum Corp., Magnolia Petroleum Co., and by Stanolind Oil & Gas Co. in Winkler County, Texas.

*Shell Petroleum Corp.

Gulf Coast

Grade A and Grade B specifications discontinued by leading buyers.

	(See gravity table)
Tomball (see note)*	$1.15
Livingston (Sept. 29, 1933)†	1.00
Cleveland (Jan. 11, 1934)	1.00
Greta (Sept. 29, 1933)	.85
Refugio, light	(See gravity table)
Refugio, heavy (Sept. 29, 1933)‡	.85
Markham and High Island	(See Gulf Coast gravity table)
Conroe	(See Conroe gravity table)

Note—Tomball, effective September 29, by Humble Oil & Refining Co. and October 2, by Magnolia Petroleum Co., and November 10, by Stanolind Oil & Gas Co.

*Greta posted by Texas Co. †Shell Petroleum Corp. ‡Refugio heavy, by Humble Oil & Refining Co. Cleveland (Liberty County), posted by Magnolia Petroleum Co.

South Central and Southwest Texas

(See note below table)

Darst Creek	$.87
Mirando	.80
Luling (Sept. 29, 1933)	.75
Pettus	1.05
Salt Flat	.87
Lytton Springs (Sept. 29, 1933)	.95
Duval County (Sept. 29, 1933)	.80
Saxet	.85

Note—Effective on September 29 by Humble Oil & Refining Co., in Darst Creek, Mirando, Pettus, Salt Flat and Saxet. Effective September 29 in Darst Creek by Gulf Pipe Line Co. and Texas Co. Effective October 2 by Magnolia Petroleum Co. Effective in Pettus and Salt Flat on September 29 by Humble Oil & Refining Co. and Gulf Pipe Line Co. Luling and Lytton Springs by Magnolia Petroleum Co. Duval County by Texas Co. Saxet, effective September 29, by Humble Oil & Refining Co. and Texas Co.

(Continued on Page R-331)

TANK WAGON MARKETS

Quotations for gasoline and kerosene in United States, as furnished by the larger marketing concerns, include taxes

August 21, 1934

Taxes

The gasoline quotations given in the following tables include the 1 cent Federal tax, as well as state, county and city taxes. The gasoline quoted is the regular or standard grade. In most marketing areas a third grade and a premium grade are also available.

Discounts

Under the standard form of commercial consumer contract which went into effect March 1, 1934, save in California, Oregon, Washington, Arizona and Nevada, a discount of 1 cent a gallon off tank wagon, or 3 cents a gallon off retail prices, is permitted for purchases running between 3,000 and 10,000 gallons a month, and 2 cents a gallon off tank wagon, or 4 cents a gallon off retail prices, for purchases in lots of more than 10,000 gallons a month. The minimum delivery is 25 gallons.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Denver, Colo.	19.0	21.0	6.0	10.0
Pueblo	19.0	21.0	6.0	13.0
Grand Junction	21.5	23.5	6.0	15.0
Casper, Wyo.	18.0	20.0	5.0	11.5
Cheyenne	18.0	20.0	5.0	13.0
Butte, Mont.	21.0	23.0	5.0	17.5
Billings	22.5	24.5	6.0	16.5
Helena	23.0	25.0	6.0	17.5
Great Falls	21.5	23.5	6.0	17.5
Salt Lake, Utah	17.0	19.0	5.0	16.0
Boise, Idaho	22.5	24.5	6.0	18.0
Twin Falls	22.5	24.5	6.0	18.0
Albu'que, N. M.	18.0	20.0	*7.0	13.0

*One-cent city tax.

Effective March 1, 1934, discount to dealers with or without contract throughout Continental territory: Undivided dealer discount off service station price, 4 cents; divided dealer accounts, 3½ cents.

Standard Oil Co. (Indiana)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Chicago	15.3	17.3	4.0	8.0
Decatur, Ill.	16.0	18.0	4.0	10.2
E. St. Louis	16.0	14.5	4.0	9.5
Joliet	14.2	16.2	4.0	10.2
Peoria	14.7	13.9	4.0	10.2
Quincy	16.6	17.1	4.0	10.0
Davenport, Ia.	16.6	17.1	4.0	10.1
Des Moines	14.0	17.1	4.0	8.0
Mason City	16.6	17.1	4.0	9.3
Sioux City	13.9	13.9	4.0	9.7
Duluth, Minn.	17.2	19.2	4.0	10.4
Mankato	16.5	16.5	4.0	10.3
Minneapolis	14.9	16.9	4.0	10.4
LaCrosse, Wis.	18.3	20.3	4.8	10.8
Green Bay	17.7	19.7	5.0	10.2
Milwaukee	17.1	19.1	5.0	9.7
Madison	17.4	19.4	5.0	9.9
Detroit, Mich.	16.0	18.0	4.0	10.5
Grand Rapids	16.7	17.7	4.0	10.2
Saginaw	17.0	18.0	4.0	10.5
Evansville, Ind.	17.7	19.7	5.0	10.0
Indianapolis	17.9	19.4	5.0	10.2
South Bend	18.2	20.2	5.0	10.5
Fargo, N. Dak.	17.9	19.9	4.0	12.1
Huron, S. Dak.	18.8	20.8	5.0	11.4
Sioux Falls	18.4	20.4	5.0	10.9
Kans. C., Mo.*	15.0	15.0	4.0	9.2
Springfield	15.1	17.1	3.5	9.1
St. Louis	15.0	17.0	3.5	8.7
St. Joseph*	11.4	12.4	4.0	8.8
Wichita, Kans.	14.6	16.6	4.0	10.2
Bartlesville, Ok.	16.0	18.5	5.0	10.5

*State tax 2 cents, 1-cent city tax and 1-cent Federal tax.

Discounts to dealers, effective March 1, 1934: Undivided accounts, 4 cents a gallon on Red Crown Ethyl and Standard Red Crown. Divided accounts, 3½ cents a gallon on Red Crown Ethyl and Standard Red Crown.

Stanolex Furnace Oil in Chicago

Effective June 27, 1934, f.o.b. Chicago, tank wagon prices: No. 1 (36-40 lt. stw. zero), under 100 gallons, 8¼ cents. Effective May 16, 1934, No. 2 (30-34 stw. zero), under 150 gallons, 7⅛ cents; No. 3 (32-36 zero), under 150 gallons, 7⅛ cents; No. 4 (12-16 zero), under 400 gallons, 6 cents; viscosity of No. 4, 90-115 at 100° F.; No. 5, under 400 gallons, 5⅝ cents. For deliveries above stated quantities deduct 1 cent.

Naphtha

	Tank wagon*
Oleum spirits	16.9
V.M.&P. naphtha	13.0
Cleaners' naphtha	13.0
Stanisol	18.0

*Prices include 3-cent Illinois tax, but not 1-cent Federal tax.

Prices f.o.b. Chicago, September 13, 1933. Each of above prices subject to discount of 1 cent per gallon for 150-gallon lots if covered by contracts.

Southern District

STANDARD OIL CO. (KENTUCKY)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Atlanta, Ga.	19.0	22.0	7.0	14.5
Augusta	20.0	22.0	7.0	14.5
Macon	20.0	22.0	7.0	14.5
Savannah	19.0	21.0	7.0	14.0
Birm'ham, Ala.	18.0	20.0	8.0	11.0
Mobile	20.5	22.5	8.0	12.0
Montgomery	22.5	24.5	8.0	15.0
Jackson, Miss.	18.5	20.5	7.0	13.0
Vicksburg	14.5	16.5	7.0	14.0
Jack'ville, Fla.	18.0	20.0	8.0	11.5
Miami	18.0	20.0	8.0	13.5
Pensacola	17.0	19.0	8.0	13.5
Tampa	18.0	20.0	8.0	12.5
Lexington, Ky.	18.5	20.5	6.0	11.5
Covington	17.0	19.0	6.0	11.5
Louisville	18.0	20.0	6.0	11.0
Paducah	14.0	16.0	6.0	11.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city and county tax of 2 cents on gasoline and one-half cent on kerosene. Kerosene prices in Georgia and Mississippi include 1 cent state tax; in Alabama, an inspection fee of one-half cent on kerosene and one-fortieth cent on gasoline; in Florida an inspection fee of one-eighth cent on kerosene and gasoline. To Pensacola, Mobile and Birmingham state taxes on gasoline add 1 cent city tax.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Dallas, Tex.	14.0	16.0	5.0	8.0
Fort Worth	14.0	16.0	5.0	8.0
Houston	14.5	16.5	5.0	8.5
San Antonio	16.0	18.0	6.0	8.5
El Paso	18.0	20.0	5.0	11.0
Muskogee, Ok.	16.0	18.0	5.0	7.5
Okla. City	15.0	17.0	5.0	8.5
Tulsa	16.0	18.0	5.0	8.5
Ft. Smith, Ark.	16.5	18.5	5.0	8.0
Little Rock	16.5	18.5	7.5	9.0
Texarkana	17.0	19.0	5.0	8.0

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Atl'tic City, N.J.	19.0	18.5	4.0	10.0
Newark	18.3	17.8	4.0	9.5
Annapolis, Md.	19.6	19.1	5.0	10.0
Baltimore	19.1	18.6	5.0	9.5
Cumberland	20.6	20.1	5.0	12.7
Wash'g'n, D. C.	17.8	16.8	3.0	11.5
Danville, Va.	21.7	21.2	6.0	12.9
Norfolk	20.2	19.7	6.0	11.3
Petersburg	20.5	20.0	6.0	11.4
Richmond	20.5	20.0	6.0	11.7
Roanoke	21.8	21.3	6.0	12.9
Charls'n, W. Va.	20.0	19.5	5.0	12.6
Parkersburg	19.2	18.8	5.0	11.2
Wheeling	20.0	19.0	5.0	13.2
Charlotte, N. C.	23.4	22.9	7.0	13.5
Hickory	23.7	23.2	7.0	13.7
Mt. Airy	23.7	23.2	7.0	13.8
Raleigh	23.2	22.7	7.0	13.3
Salisbury	23.5	19.0	7.0	13.6
Charleston, S. C.	21.2	20.7	7.0	11.3
Columbia	23.0	22.0	7.0	13.2
Spartanburg	23.4	22.4	7.0	13.5

Price basis to dealers: Divided dealers at dealer price, which is 2½ cents above tank car; undivided dealers at regular price less one-half cent. Discount for kerosene, 1 cent off tank wagon price for 25 gallons or more under contract (contract not necessary in Baltimore) except in New Jersey, where no discount is given.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Omaha	17.0	19.0	5.0	10.0
McCook	17.7	19.7	5.0	10.7
Norfolk	17.4	19.4	6.0	10.4
North Platte	17.8	19.8	5.0	10.8
Scottsbluff	18.5	20.5	5.0	11.5

Note—Discount to dealers, including any rentals under lease and agency agreements: Undivided accounts, Standard Red Crown and Red Crown Ethyl Gasoline 4 cents. Reliance (third brand) 3 cents, under service station price. Divided accounts, Standard Red Crown Ethyl Gasoline 3½ cents. Reliance (third brand) 2½ cents, under service station price. Discounts to consumers covered only by form CD-1, official commercial consumer contract.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
N. Orleans, La.	20.8	15.0	*7.0	†10.0
Baton Rouge	20.2	19.7	6.0	†13.0
Alexandria	21.1	18.5	*7.0	†10.0
Lafayette	21.3	20.8	*7.0	†13.0
Lake Charles	21.2	20.7	*7.0	†13.0
Shreveport	19.0	15.5	6.0	†13.0
Knoxville, Tenn.	24.7	21.5	8.0	13.0
Memphis	23.1	21.5	8.0	10.5
Chattanooga	24.5	21.5	8.0	12.0
Nashville	24.0	21.5	8.0	11.0
Bristol	24.5	21.5	8.0	14.0

*Includes city tax of 1 cent. †Louisiana kerosene prices include 1-cent state tax.

Price bases to dealers: Divided dealers at dealer price, which is 2½ cents above tank car; undivided dealers at dealer price less one-half cent.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA*

	Gasoline: Tank wagon†	Gasoline: Posted retail	Gasoline: Incl'ds tax	Kero. tank wagon
San Francisco	17.5	19.5	4.0	12.5
Los Angeles	15.5	17.5	4.0	12.5
Fresno, Calif.	18.0	20.0	4.0	14.0
Phoenix, Ariz.	20.0	22.0	6.0	‡16.0
Reno, Nev.	20.0	22.0	5.0	15.5
Portland, Ore.	20.0	22.0	6.0	13.5
Seattle, Wash.	20.0	22.0	6.0	13.5
Tacoma	20.0	22.0	6.0	13.5
Spokane	23.0	25.0	6.0	18.0

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Prices are at company's plant or depots, as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent.

‡Includes 5-cent state tax.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Philadelphia, Pa.	15.5	17.5	4.0	10.0
Pittsburgh	16.0	18.0	4.0	10.0
Allentown	15.5	17.5	4.0	10.0
Erie	16.0	18.0	4.0	9.0
Scranton	16.0	18.0	4.0	10.0
Altoona	16.0	18.0	4.0	10.0
Dover, Del.	16.0	18.0	4.0	10.0
Wilmington	15.5	17.5	4.0	9.0
Springf'd, Mass.	15.5	17.5	4.0	8.75
Worcester	15.5	17.5	4.0	9.0
Hartford, Conn.	15.0	17.0	3.0	8.5
New Haven	14.0	16.0	3.0	8.5
Providence, R.I.	13.0	15.0	3.0	8.5

Note—Tank wagon prices are those applicable to consumers purchasing lots of 100 or more gallons in one delivery.

New York and Part of New England

STANDARD OIL CO. OF NEW YORK

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Albany, N. Y.	16.0	17.0	4.0	9.0
Met. New York	16.5	17.5	4.0	8.5
Buffalo	17.5	18.5	4.0	9.0
Rochester	17.0	18.0	4.0	9.25
Syracuse	17.0	18.0	4.0	9.25
Boston, Mass.	13.0	14.0	4.0	8.5
Portland, Me.	18.3	19.3	5.0	8.75
Manch't'r, N. H.	19.2	20.2	5.0	9.0
Burlington, Vt.	19.8	20.8	5.0	9.75

Commercial consumers allowed 2 cents discount below service station prices in accordance with CD-1 of oil industry's code.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Ohio points	17.5	19.5	5.0	*13.5

*Includes state tax of 1 cent, effective July 22.

Canada*

IMPERIAL OIL, LTD.

Imperial 3-Star Gasoline

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax	Kero. tank wagon
Hamilton, Ont.	†21.0	23.5	6.0	17.5
Toronto, Ont.	†21.0	23.5	6.0	17.5
Brandon, Man.	30.3	33.3	7.0	21.8
Winnipeg, Man.	28.7	31.7	7.0	20.3
Regina, Sask.	29.0	32.0	6.0	21.5
Saskatoon, Sask.	31.5	34.5	6.0	24.3
Edmonton, Alta.	31.2	34.2	6.0	23.7
Calgary, Alta.	28.5	31.5	6.0	21.9
Vancouver, B.C.	†28.0	31.0	7.0	24.0
Montreal, Que.	24.0	27.0	6.0	17.8
St. John, N.B.	26.0	30.0	8.0	21.0
Halifax, N. S.	26.0	30.0	8.0	21.0

Imperial gallon used in Canada. †Governed by service station price.

Maritime provinces, all deals 4 cents off service station price. All other provinces open dealers 2.5 cents off service station price and 1 cent additional to 100 per cent accounts.

Retail Price Changes

Regular-Grade Gasoline and Kerosene

Atlantic Refining Co. August 13 advanced tank wagon and station gasoline 2 cents in Providence.

Continental Oil Co. August 15 advanced tank wagon and station gasoline 1 cent in Denver and Pueblo. August 15 advanced tank wagon and station gasoline 3½ cents in Grand Junction.

Standard Oil Co. of Nebraska August 6 reduced station gasoline 1½ cents in Norfolk. July 27 advanced tank wagon kerosene 2.3 cents in Norfolk. August 13 advanced station gasoline 2 cents and tank wagon kerosene 1 cent in Omaha. August 13 advanced station gasoline 1.3 cents and tank wagon kerosene 3.8 cents in McCook. August 13 advanced tank wagon gasoline 1.5 cents and reduced tank wagon kerosene .9 cents in Norfolk. August 13 advanced tank wagon gasoline .8 cent, station gasoline 2.8 cents and tank wagon kerosene 1.8 cents in North Platte. August 13 advanced tank wagon gasoline .2 cent, station gasoline 2.2 cents and tank wagon kerosene 2.5 cents in Scottsbluff.

Standard Oil Co. of New Jersey August 9 reduced station gasoline 1.5 cents in Salisbury.

Magnolia Petroleum Co., August 14, reduced tank wagon and station gasoline .1 cent in Fort Smith.

EQUIP CANADIAN REFINERY

COUTTS, Alberta, Aug. 18.—Since acquiring the refinery of the Northwest Stellarene Co. here some months ago, the British-American Oil Co. has made important extensions. An additional 5 acres has been purchased for the site, on which five new storage tanks have been erected. A new 13-tier California cooler, one of the latest refinery water cooling systems, has also been provided.

The buildings on the old Alberta Refining Co. property have been converted into warehouses and a new warehouse erected, as well as a new and modernly-equipped laboratory and an ethyl-treating plant. Grading has been done for a new two-track loading rack which, when completed, will more than double the present loading rack capacity.

The plant throughout has been overhauled and brought up to the operating standard of the British-American plants in eastern Canada. Officials of the company expect to have the construction work completed by September.

The plant has run at full capacity throughout the summer. Recently connection has been made with the new pipe line of the Toronto Pipe Line Co. from the Cut Bank Field, and Montana crude is now delivered direct to the refinery.

CODE TO SUPREME COURT

WASHINGTON, D. C., Aug. 20.—A supreme court test of the Government's authority to regulate oil production was assured when Solicitor General Biggs filed a memorandum stating the Government would interpose no objection to a review of a case brought by the Panama Refining Co. and others. The company challenged the validity of Section 9(C) of the recovery act and regulations issued under it by Secretary Ickes controlling production under the petroleum code.

Late Fields

OKLAHOMA

John B. Nichlos' No. 6 Farwell, NE NE Section 26-5n-8w, Grady County, in the Chickasha gas field, looks more promising than before. On Monday it was making 200 bbls. of oil per day through 305 feet of mud, shale and sand which had settled in the 310-foot liner. Eight-inch casing is set at 2,932 feet and the total depth of the hole is 3,220 feet. It is the first oil showing in the gas field and caused widespread interest when it first showed oil two or more weeks ago.

A general meeting of operators in the Fitts Pool was held in Ada, Monday to discuss the question of allowable production in the pool, which is now limited to 1,000 bbls. per day. No statement was given out as to the trend of the discussion. A number of operations which have been mentioned as locations are rapidly approaching the spudding stage. Material is being moved in, or derricks are being built. There are no drilling wells close enough to the Wilcox sand to make them interesting at this time.

Phillips Petroleum Co.'s No. 2, C NW NW SW Section 10-7-4, South St. Louis area, Pottawatomie County, was acidized with an oil load in Hunton lime at 3,668-3,910 feet and on three successive days produced 328 bbls., 200 bbls., and 100 bbls. The well may be reacidized. Same company's No. 3, C SW NW Section 10-7-4, had Hunton lime at 3,632-3,736 feet and after it was acidized produced 260 bbls. in one day and 190 bbls. the next day.

KANSAS

Continental Oil Co.'s No. 2, C NW NW SE Section 7-20-9, Rice County, found Siliceous lime at 3,256-92 feet and acidized it. The well pumped 1,018 bbls. in 24 hours on a potential test.

ROCKY MOUNTAIN RUNS

Estimated production in the Rocky Mountain area for the week ending August 18 follows:

	Bbls.
WYOMING	
Salt Creek	18,030
Big Muddy	1,750
Badger Basin	40
Black Mountain	400
Byron	80
Dallas Derby	600
Dutton Creek	80
Elk Basin	600
Ferris	20
Frannie	2,400
Garland	1,730
Grass Creek	1,500
Greybull	10
Hamilton Dome	990
Hudson	300
LaBarge	1,500
Lance Creek	270
Lost Soldier	1,720
Mule Creek	shut in
Midway	100
Notches	shut in
Oregon Basin	3,200
Osage	1,070
Pilot Butte	shut in
Rex Lake	20
Rock River	1,490
South Casper	620
Poison Spider	240
Teapot	20
Total Wyoming	38,880
MONTANA	
Buckley-Border	250
Cat Creek	590
Cut Bank	3,150
Dry Creek	shut in
Kevin-Sunburst	4,650
Lake Basin	50
Pondera	720
Total Montana	9,410
COLORADO	
Florence	170
Fort Collins and Wellington	580
Iles Dome	1,850
Moffat	480
Orchard	110
Rangely	90
Tow Creek	140
Total Colorado	3,420
NEW MEXICO	
Artesia	510
Cooper area	390
Empire area	110
Eunice area	2,100
Getty Pool	shut in
Hobbs	26,400
Hogback	200
Hospah	shut in
Jal	2,860
Lea area	1,840
Jackson	1,070
Maljamar	290
Rattlesnake	660
Table Mesa	90
Total New Mexico	46,520
Total Rocky Mountain region	98,230

PIPE LINE CONSTRUCTION

Sun Oil Company Gasoline Pipe Line to Be Extended Hundred Miles in East

NEW YORK, Aug. 21.—The Middlesex Pipe Line Co. has been organized as a wholly owned subsidiary of the Sun Oil Co. for the purpose of extending the gasoline pipe line system of the Sun company in the East. According to present plans a line will be built from Malvern, west of Philadelphia, to some point on the northeast coast of New Jersey. The exact location of the terminal has not been determined at this time.

It is planned to build the line this winter provided prices for pipe are satisfactory at that time, according to officials. The line will be 100 miles long and will cost approximately $500,000. The line will give the company a terminal in a section in which are located several of the largest refineries and water terminals on the Atlantic Seaboard. It will be used as a base for inland water and coastal distribution covering a territory in which the Sun company has steadily increased its distributing facilities over the past few years.

The Sun company at present is the largest user of gasoline pipe lines in the East. Through the Susquehanna Pipe Line Co., a subsidiary, the company owns and operates an 8 and 6-inch pipe line system connecting to Syracuse, N. Y., and Cleveland, Ohio. This line is approximately 700 miles in length and has a capacity of 25,000 bbls. daily. It connects to the company's large refinery at Marcus Hook, Pa.

PIPE ORDERS

Standard Oil Co. of California will buy about 14,256 tons of 12-inch steel pipe for its new line. Republic Steel Corp. is delivering 4,125 tons of steel pipe for a gas line to be laid in Michigan by subsidiaries of the American Light & Traction Co., Chicago.

CONTRACTS AWARDED

A contract was awarded Smith Brothers Construction Co., Kansas City, Mo., to lay 12,600 feet of 27-inch welded water pipe line for Ponca City, Okla., new water supply project developed by W. R. Holway, consulting engineer, Tulsa, which will also include two dams, storage reservoir and filter plant. The contract also includes the laying of 5,705 feet of 12¾-inch American Rolling Mill spirally welded steel pipe one-quarter inch thick. The 27-inch diameter pipe has five-sixteenths inch walls and is made by Taylor Forge & Pipe Works Co.. The lines will be coated inside and outside with Hermastic enamel and welded together in the field.

On August 6 a contract was awarded to C. S. Clark Construction Co. of Oklahoma City to lay 31,800 feet of 10¾-inch spirally welded steel pipe, three-sixteenths inch walls made by the American Rolling Mills. This pipe is part of the new water system for Cleveland, Okla., which will also include an earth dam, storage reservoir and concrete covered reservoir filter plant and pump station all designed by W. R. Holway, consulting engineer, Tulsa, and O. F. Sewell, Pawnee, Okla. The pipe line will be coated with Hermastic enamel inside and outside and welded in the field.

MECOSTA-MUSKEGON LINE

MUSKEGON, Mich., Aug. 20.—Pipe has been ordered for the proposed new 55-mile natural gas line from the Austin Township, Mecosta County, Pool to Muskegon, it is announced by Chester N. Chubb, president of the American-Michigan Pipe Line Co., which will build the line.

Although actual construction will be delayed pending a final report on reserves proved by the last 9,000,000-foot gasser completed in the Michigan gas sands by Taggart Brothers, Inc., it is believed the word to go ahead will be issued this week.

About 12 miles of the detailed location survey has been completed and virtually all of the right of way obtained. Edward L. Fischer, of Davenport, Iowa, United Light & Power Co. engineer, who will have charge of laying the line, has arrived in Muskegon.

R. B. Brown, former head of the Muskegon Gas Co. and also a vice president of the American Light & Traction Co., as is Mr. Chubb, attended meetings of the two Muskegon subsidiaries in Muskegon last week at which plans for furnishing natural gas to 12,000 consumers in Muskegon and Muskegon Heights were discussed.

LLOYDMINSTER PIPE LINE

LLOYDMINSTER, Saskatchewan, Aug. 18.—The formal turning of the first sod for the pipe line to deliver gas from the new gas field to Lloydminster took place recently, with Mayor G. L. Cooke officiating. About a mile of transmission line, together with a local distributing system, will be laid, and it is expected gas will be delivered this fall. The Lloydminster Gas Co. holds the local natural gas franchise. The line is the first natural gas pipe line ever laid in Saskatchewan, Canada.

REFINERY PIPE LINE LINK

COUTTS, Alberta, Aug. 18.—Some 3,000 feet of line has been laid to link the British American Oil Co. refinery here with the pipe line recently laid by the Toronto Pipe Line Co. from the Cut Bank Field in Montana. Crude shipments heretofore have been made to the refinery by tank car.

The Oil Man's Calendar

August

24-27—Titusville, Pa., Drake Well Memorial Celebration.

September

9—Wernersville, Pa., American Trade Association executives.

10-14—Cleveland, Ohio, American Chemical Society.

11-12—Louisville, Ky., Kentucky Petroleum Marketers Association, Brown Hotel (dates tentative).

12-14—Atlantic City, N. J., North American Gasoline Tax Conference, Claridge Hotel.

19-21—Atlantic City, N. J., National Petroleum Association.

26-27—Columbus, Ohio, Ohio Petroleum Marketers Association, Deshler-Wallick Hotel.

October

1-5—Cleveland, Ohio, National Safety Council, Cleveland, Statler, Carter and Hollenden Hotels.

9—Michigan Independent Petroleum Distributors Association, place to be named later.

12-13—American Institute of Mining Engineers, Petroleum Division, fall meeting, Tulsa, Mayo Hotel.

16-18—Big Four State Jobbers Association Convention, Kansas City, Mo.

29—American Gas Association Convention and Exhibition, Atlantic City, N. J.

November

5-9—Cleveland, Ohio, Automotive Service Industries Show, Cleveland Public Auditorium.

Los Angeles, Calif., American Association of Petroleum Geologists, Pacific section.

12-15—Dallas, Tex., annual meeting, A.P.I.

December

3-8—New York, National Exposition of Power and Mechanical Engineering, Grand Central Palace.

January

7—New York, Society of Automotive Engineers, annual dinner.

P. & C. Program Committee to Extend Gasoline Buying

(Continued from Page 10-R)

the gasoline manufactured during the preceding month was from legally produced oil, legally imported oil, or oil withdrawn from storage in compliance with the provisions of the code. Also included in this report will be statements as to the number of barrels of crude oil or other products run through each refinery of the operator in the district and produced by the refiner during the preceding month; the number of barrels run through each refinery of the operator in the district and purchased by refiner during the preceding month; name and addresses of all brokers or other persons from whom crude oil or the products thereof was purchased and the amount of each purchased during the preceding month; decsription and identification of all leases and ownership of such leases from which crude oil was run to each refinery of operator during the preceding month; methods of transportation from lease tanks to each refinery of operator during the preceding month and the name, ownership and address of the pipe line, if any, through which such crude oil or its products were transported.

New Form of Contract

In order to relieve the market of the large amount of stored gasoline which has been produced from "hot oil," the committee is preparing a new form of contract for submission to Administrator Ickes which it is expected will allow the shipping of this gasoline, thus alleviating this pressure on the market. The committee is asking that this gasoline be allowed to move into commerce without first obtaining the affidavits required for Class B shipments under Regulations 6 of the "hot oil" regulations when such shipment is made under the proposed new form of contract.

The effective carrying out of this program, it is felt here, will greatly relieve the gasoline market. The program in East Texas has clearly shown that a program such as this can be carried out and it is expected that, on a national scale, the effect upon the industry will be even more beneficial than the Texas buying plan.

IMPERIAL OIL PICNIC

SARNIA, Ontario, Aug. 18.—The annual picnic of the Imperial Oil Employes' Social and Athletic Association was held at Canatara Park last week, with an attendance estimated at 1,200.

Andrews County Well Treated, May Be Shot; Drought Still Hampers Wichita Falls Area

By L. E. BREDBERG

Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Aug. 20.—The discovery well of Humble Oil & Refining Co., No. 1 R. M. Means, in north central Andrews County, was treated with 3,000 gallons of acid and responded with 153 bbls. of fluid in 12 hours through three-quarters inch tubing choke, showing 6 per cent basic sediment with no water. It is making an estimated 600,000 feet of gas. Before treating it was making an estimated 200 bbls. of oil per day. Total depth is 4,472 feet. It will probably be given a shot. It is in Section 2, Block A-35, P.S.L. Survey.

Bonds and others have derrick for a wildcat in Section 29, Block 3, P.S.L. Survey, Andrews County, on the McCarley land about 12 miles southeast of Humble Oil & Refining Co.'s No. 1 Means and about the same distance east of the Ford area. Another location for a wildcat will probably be announced soon by Hanagan and Crump for a 5,000-foot test, probably in Section 4, Block A-37, P.S.L. Survey, about 20 miles northeast of the discovery.

The wildcat of Honolulu Oil Co. and Llano Oil Co.'s No. 1 Parker, in Section 7, Block A-44, P.S.L. Survey, about 5 miles northeast of the Ford area and the same distance from the Deep Rock area and was reported to have topped the Yates sand at 3,154 feet, considerably lower than the producing wells in the Deep Rock and Ford areas. The operators are running 8-inch casing at 3,220 feet.

Ector County

The North Cowden area, in Ector County, was about to get two extensions late in the week when Landreth Production Co.'s No. 1-C T. P. Land Trust, a half mile south of production, topped the pay at 4,120 feet from which oil rose 100 feet per hour. It is in Section 11, Block 43, Township 1s, T.&P. Survey. The same company's No. 2-A T. P. Land Trust, a quarter mile west of production, encountered water from 4,257-67 feet and was plugged back from 4,270 feet to 4,250 feet. It will be shot from 4,090 to 4,178 feet, where it had a showing of oil. It is in Section 3, Block 43, Township 1s, T.&P. Survey.

In the Penn Pool, Texas Co.'s No. 10 Connell extended the field one-half mile west when it filled 300 feet with oil while drilling at 3,505 feet. The first showing was encountered at 3,475 feet with an increase from 3,502-79 feet. It is in Section 1, Block B-16, P.S.L. Survey.

Brandon and McCamey's No. 1 J. Cowden, a wildcat southwest of the Church-Fields Pool in Section 3, G.H.&H. Survey, was abandoned after a 100-quart shot from 2,800-94 feet. It made 5 bailers of oil in 24 hours after shot. It was drilled to 3,352 feet and was plugged back after it encountered sulphur water at 3,203 feet.

Crane County

It is reported Gulf Production Co. is planning to deepen Loffland Brothers' No. 1 Tubbs in Crane County to the Ordovician lime. The test, a wildcat, in Section 9, Block B-27, P.S.L. Survey, was temporarily abandoned at a total depth of 4,510 feet several months ago. Six and five-eighths inch casing is set at 4,281 feet. It would make the seventh Ordovician test in the district and the second for Crane County.

Tom Green and Crockett

Two wildcat tests in Tom Green and Crockett Counties were abandoned. Southwest Exploration Co.'s No. 1 John Bennett, in the eastern part of Tom Green County, was abandoned at a total depth of 3,398 feet after getting 1,000 feet of salt water from 3,340-50 feet. It is in Section 1,628 in the Behringer Survey. In Crockett County, but 6½ miles southeast of the Yates Pool in Pecos County, Eppenauer Drilling Co. abandoned No. 1 J. W. Owens at a total depth of 1,875 feet after encountering sulphur water at 1,870 feet. It is in Section 12, Block GG, T.&N.O. Survey.

Winkler County

Two wildcat tests in Winkler County continue to hold interest, due to showings of oil and gas. Four miles east of the south end of the Hendrick Pool, Skelly Oil Co.'s No. 1 S. M. Halley encountered a show of gas at 2,680 feet, with oil showings from 2,690-98 feet and 2,790-2,800 feet. Another gas show was encountered at 2,880 feet. The test is in Section 25, Block B-11, P.S.L. Survey, and is drilling below 2,967 feet. The other test is in the northern part of the county, midway between the Hendrick Pool and the Scarborough Pool. It is being drilled by Sayre Oil Co. on the J. F. Howe land. The operators are drilling a larger hole to get by a drilling bit lost after it had encountered an estimated 6,000,000 feet of gas at 2,635 feet. It is in Section 12, Block 26, P.S.L. Survey.

Pecos County

In Pecos County, Tex-Mex Petroleum Corp.'s No. 1 Netterville is still fishing for tools blown up the hole last week by an estimated 2,500,000 feet of gas encountered at 2,210 feet. It is in the northwestern part of the county in Section 59, Block 8, H.&G.N. Survey.

Ordovician Tests

Two Ordovician tests in Reagan and Schleicher Counties got under way during the week. Skelly Oil Co. and others' No. 1-D University-Grayson was drilling below 330 feet carrying an 18-inch hole. It will be carried to 500 feet before the rotary is installed. It is about 8 miles southeast of the Big Lake Pool, the only pool in the district producing from the Ordovician lime. In Schleicher County, Humble Oil & Refining Co.'s No. 1 Ike Honig started drilling with rotary at 609 feet, in Section 38, Block M, G.H.&S.A. Survey.

Sixteen locations were made in the district during the week divided among Andrews, Ector, Glasscock, Howard, Ward and Winkler Counties. Completions were registered in Loving, Glasscock, Howard and Winkler Counties.

WICHITA FALLS DISTRICT

The water shortage in the Wichita Falls and Ranger districts is becoming more acute every day. Continental Oil Co., which has been furnishing water to operators in the Falls County School Land producing area of Archer County, has withdrawn its supply from those operators and they have been forced to ship water in from other areas by tank cars and haul it in by trucks.

There were only 35 locations staked in both districts during the week, with only 28 tests completed, 10 of which were dry and abandoned. Several locations were abandoned.

Continental Oil Co.'s No. 1 Lawler, in the southwest corner of the Thomas Leftwich Survey, has extended production 1,000 feet northeast to the Beck production in Montague County. The Beck Pool wells produce from two pay horizons, found at around 1,500 and 1,700 feet. This well logged broken sand and shale from 1,708-23 feet and the oil sand pay from 1,723-32 feet. It swabbed at the rate of 30 bbls. per hour. It opens production north and east of the original Beck lease, in a trend extending from the Bulcher Pool across the line in Cooke County.

Leidecker and Fields' No. 1 McClure, in the northwest corner of the east half of T.E.&L. Survey No. 2,740, is showing for a deep well in the lime pay at 4,523-34 feet, with gas estimated at 2,000,000 feet. A show of oil was logged at 4,549-97 feet and from 4,597-99 feet, total depth. It was straightreamed and 6-inch casing set at 4,515 feet. It will probably be shot. Shell Petroleum Corp. brought in a well in the 4,500-foot pay on the Williams ranch, 11 miles southeast in 1922, which is still producing 8 bbls. per day. It was recently treated with acid, but was not affected.

PANHANDLE DISTRICT

There were 12 locations staked in the Panhandle district this week and 18 tests were completed, which added another 8,000 bbls., 4 wells making over half of the new production. Four gas wells added 2,500,000 feet of gas to the daily potential of the Panhandle area.

Production from the district averaged 61,200 bbls. per day during the week, an increase of 5,300 bbls. per day over the previous week.

COMPLETIONS IN WEST TEXAS

Glasscock County

Luce and Pickens' No. 1 Lee, top pay 2,178-79 feet, initial production 1,080 bbls. per day, total depth 2,181 feet; No. 1 Sam Turner, top pay 2,262-68 feet, initial production 58 bbls. per hour, total depth 2,268 feet. Schermerhorn's No. 1 Phillips, pay 2,450-59 feet, initial production 59 bbls. per hour, total depth 2,456 feet. Shell Petroleum Corp.'s No. 2 Coffee, pay 2,119 feet, initial production 75 bbls. per day with 600 bbls. of sulphur water, total depth 2,164 feet.

Howard County

Sinclair Prairie Oil Co.'s No. 12 Dodge, shot with 300 quarts from 2,610-2,810 feet, initial production 110 bbls., total depth 2,810 feet.

Irion County

Colgin's No. 1 Tankersley, dry and abandoned, total depth 2,180 feet.

Tom Green County

Southwest Exploration Co.'s No. 1 Bennett, dry and abandoned, total depth 3,398 feet.

Upton County

Texas Pacific Coal & Oil Co.'s No. 3 Ruse, pay 2,535 feet, initial production 178 bbls., total depth 2,600 feet.

Winkler County

Sid Richardson's No. 1-E Scarborough, pay 2,883 feet, initial production 71 bbls., total depth 3,142 feet; No. 1-F Scarborough, pay 2,881 feet, initial production 475 bbls., total depth 3,004 feet.

COMPLETIONS IN NORTH TEXAS

Clay County

L. S. Dennis' No. 1 Morbitz, dry and abandoned, total depth 1,006 feet.

Cooke County

Petroleum Producers Co.'s No. 2 Andress, temporarily abandoned.

Grayson County

Vern Dumas' No. 1 Williams, dry and abandoned, total depth 5,046 feet. C. R. Threlkeld's No. 1 Potts, dry and abandoned, total depth 450 feet.

Jack County

Guffey and Carpenter's No. 1 Craig, dry and abandoned, total depth 350 feet. A. C. Parks' No. 1 Webb, dry and abandoned, total depth 1,017 feet.

Archer County

Fain & McGaha's No. 20 Green, dry and abandoned, total depth 1,192 feet. Petroleum Producers Co.'s No. 2 Harmonson, oil sand 964-70 feet, initial production 200 bbls., total depth 970 feet. C. J. Kleiner's No. 5, oil sand 961-73 feet, initial production 20 bbls., total depth 973 feet. Fain & McGaha's No. 1-F Logan, abandoned location; No. 3-E Logan, lime 1,147-82 feet, initial production 15 bbls., total depth 1,182 feet; No. 17 Green, lime 1,157-76 feet, initial production 300 bbls., total depth 1,176 feet. Bridwell and Continental Oil Co.'s No. 11 Logan, lime 1,154-57 feet, initial production 20 bbls., total depth 1,157 feet.

(Continued on Page 31-R)

J. W. McCulloch Succumbs to Injuries in Accident

J. W. McCulloch, age 43, Okmulgee, Okla., operator, died at Sherman, Tex., Wednesday, from injuries in a motor accident. He was a native of Missouri and

J. W. McCULLOCH

began his career as a clerk and butcher's boy in an Okmulgee store of which he became manager at 21. He acquired an interest in a string of drilling tools in 1917 and expanded into drilling contracting. He was one of the organizers of the Independent Oil & Gas Co., becoming vice president and manager, the company removing to Tulsa and subsequently being acquired by the Phillips Petroleum Co. Mr. McCulloch returned to Okmulgee in 1926 to establish the McCulloch Oil Co. Subsequently he was associated with the late R. H. Smith in the Oklahoma Oil Co., later the Oklahoma Oil Corp. Since then he had been operating as a drilling contractor at Tyler, Tex.

Another Area Is Eliminated by Anderson Test; Continued Activity in Cayuga and Cherokee

By L. E. BREDBERG

DALLAS, Tex., Aug. 20.—Another area was eliminated as possible producing territory in Anderson County, when Sun Oil Co. abandoned its No. 1 Erskine this week. This test is in the Samuel C. Box Survey, approximately 12 miles south of the Long Lake Field, in the southwestern part of the county. It tested salt water at 5,902 feet, total depth, and was given up as dry. Canadian Production Co.'s No. 1 Jackson, in the Caldwell Survey, approximately midway between Long Lake and Cayuga, same county, was given up last week when it tested salt water at 4,790-4,863 feet. Total depth is 5,102 feet.

The most interesting test in Cayuga, northwest Anderson County, is Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 1 Sullenberger in the William Snider Survey, an outpost on the extreme southern end. It now has chances of extending that field, but may be a defining well. It cored sand from 4,040-45 feet, the first 4 feet slightly saturated, the last foot proving salty and causing the operators to shut down and set 7-inch casing at 4,046 feet. If salt water shows up at this depth it may be plugged back to around 4,030 feet, where good saturated sand was logged prior to logging any salt impregnated formation. Total depth is 4,050 feet.

Freestone County

Trinity Farm Securities Co., or E. P. Harwell's No. 1 Stewart (fee), in the R. M. Williamson Survey, Freestone County, southwest of the Sullenberger test, and approximately 5 miles southwest of the Cayuga discovery, has been completed as a gasser, hedging the field on that side. It topped the gas sand at 3,932 feet and the Woodbine oil sand at 3,888 feet. Initial gas production was 10,000,000 feet. Total depth was 4,045 feet, but it was plugged back to 3,975 feet.

Tide Water Oil Co. and Texas Seaboard Oil Co. have made a location in the extreme northwestern corner of the W. H. C. Goode 906.48-acre tract in the Anderson County School Lands Survey, Cayuga area, approximately 1½ miles southeast of the Sullenberger test. It will prove or condemn a large amount of acreage in the jointly held block.

Three inside locations have been made in Cayuga by the Tide Water and Texas Seaboard companies on their Edens, Godley and Wills leases, respectively.

Anderson County

The most interesting test in Anderson County is Hunt Production Co.'s No. 1 O. M. Dorsey (Miller), in the S. Sanchez Survey, 2½ miles northeast of Long Lake. It is registering low on the chalk formations. Base of the Austin was reported at 5,035 feet or a subsea datum of minus 4,743 feet. It is coring below 5,100 feet.

Cherokee County

Walter Goldston and others' test on the Southern Pine Lumber Co. acreage in the N. Newton Survey, 2½ miles southeast of the Rusk discovery in Cherokee County, is drilling in Austin chalk at 4,400 feet. It is running low on both chalks. A dry hole south and west of the discovery is located between the discovery and the Goldston test.

Wilson Stubbs Oil Co. is drilling an old well deeper on the Rowborts farm in the Wilfin Survey, 2 miles southwest of Jacksonville, Cherokee County. It is being carried down from 1,530 feet.

Limestone County

A wildcat was staked 8 miles east of Thornton in Limestone County, this week, to be drilled by H. Edwards and others on the W. W. Simms farm in the J. S. Chavert Survey. There are three Woodbine sand tests going down in the county and one Trinity sand test in the Mexia Field, the latter being drilled by Peyton Brothers on the Steubenrach farm, in the P. Valera Survey. It is past 4,700 feet. Production is expected in the Trinity around 5,750 feet because of oil showing in a former Trinity sand test drilled on the same farm by the E. L. Smith Oil Co. This test also made a large volume of gas before being junked and abandoned.

R. B. Codding and others are drilling below 1,300 feet on the Lela Kelt farm in the C. B. Emmons Survey, 3 miles northeast of Chatfield in Navarro County. It is being carried down from 1,140 feet. Kelly Harris has set surface casing at 150 feet on his No. 1 T. W. Harris in the Davis Survey, 3½ miles southwest of Henderson in Rusk County. Two dry holes have been drilled in this area, one to 4,998 feet by Texas Co. on the Goodwin farm.

Boone, Wallace and others' No. 1 Trinity State Bank, in the C. H. M. Ellis Survey, in the extreme southern part of Houston County, took a core on their wildcat from 2,029-34 feet showing no recovery from the formation which appeared as sandy shale. However, a three-minute drill stem test showed about 450 feet of oil and mud. Casing will probably be set and further testing done.

Another test is planned for Hunt County, by J. C. Hall of Fort Worth, and others, on the A. B. Parrish farm in the N. Danley Survey. Rube Benton of Fort Worth, and Phillips Petroleum Co. have contracted to drill on a block of some 3,000 acres in southeastern Hopkins County, on the J. W. Jones farm in the Jasper Williams Survey.

A couple of more wildcats are slated for Cherokee County and other Woodbine wildcats have been proposed for different counties in East Texas.

EAST TEXAS

The East Texas Field continues to be extended to the northeast and east in the Jamestown area of Upshur County. Humphreys has completed a mile extension to the east on the Dunbar tract, and a south offset is being drilled by the same operator. Eastern Texas Petroleum Co., formed by Freeman Burford of Dallas, has completed several wells in the extension. The Woodbine sand is found below where it is logged in the main part of the field, or around 3,350 feet subsea depth.

There were 70 wells completed in the field this week and 103 locations staked, the latter an increase of 35 over the previous week.

COMPLETIONS IN EAST TEXAS

North Gregg County

Atachafalaya Oil Co.'s No. 4 E. L. Walker, top sand 3,568 feet, initial production 35 bbls. in one-half hour through open tubing, total depth 3,572 feet. Cal-Pet Corp.'s No. 6 Jones, top sand 3,546 feet, initial production 60 bbls. per hour through open tubing, total depth 3,624 feet. Faith Oil Co.'s No. 13 J. C. Berry, top sand 3,668 feet, initial production 55 bbls. per hour through open tubing, total depth 3,697 feet. F.H.E. Oil Co.'s No. 2 Jones, top sand 3,633 feet, initial production 30 bbls. in one-quarter hour through open tubing, total depth 3,700 feet. G.O.P. Corp.'s No. 5 Callum, top sand 3,535 feet, initial production 100 bbls. per hour through open tubing, total depth 3,558 feet. Guiberson's No. 5 Stuckey-Thrasher, top sand 3,565 feet, initial production 100 bbls. per hour through open tubing, total depth 3,615 feet. Humble Oil & Refining Co.'s No. 12 Carter, top sand 3,618 feet, initial production 79 bbls. per hour through open tubing, total depth 3,654 feet; No. 16 Harris, top sand 3,516 feet, initial production 92 bbls. per hour through open tubing, total depth 3,544 feet; No. 17 Mackey, top sand 3,558 feet, initial production 25 bbls. swabbing, total depth 3,572 feet; No. 18 Mackey, top sand 3,564 feet, initial production 6 bbls. in one-quarter hour through open tubing, total depth 3,569 feet.

Midas Oil Co.'s No. 2 Snoddy, top sand 3,584 feet, initial production 35 bbls. in one-half hour through open tubing, total depth 3,594 feet. Stamford Oil Co.'s No. 3 League, top sand 3,587 feet, initial production 25 bbls. in one-quarter hour through open tubing, total depth 3,600 feet. Hiram Reed and others' No. 1 Wood, top sand 3,660 feet, initial production 100 bbls. per hour through open tubing, total depth 3,664 feet. Selby and Lewis' No. 13-A Snavely, top sand 3,564 feet, initial production 42 bbls. in one-half hour through 1-inch tubing choke, total depth 3,580 feet; No. 6-D Snavely, top sand 3,581 feet, initial production 42 bbls. in one-half hour through open tubing, total depth 3,591 feet. Shell Petroleum Corp.'s No. 13 G. H. Slaton, top sand 3,577 feet, initial production 35 bbls. in one-half hour through open tubing, total depth 3,656 feet. Yount Lee Oil Co.'s No. 5 Stephens, top sand 3,532 feet, initial production 29 bbls. in one-half hour through eleven-sixteenths inch tubing choke, total depth 3,551 feet.

South Gregg County

Ben G. Barnett's No. 2 Loughridge, top sand 3,719 feet, initial production 25 bbls. in one-half hour through open tubing, total depth 3,720 feet. Gulf Production Co.'s No. 27 Brown, top sand 3,480 feet, initial production 52 bbls. per hour through open tubing, total depth 3,507 feet; No. 13 Cole, top sand 3,533 feet, initial production 25 bbls. in one-half hour through open tubing, total depth 3,546 feet. Hawkeye Petroleum Co.'s No. 4 B. W. Smith, top sand 3,554 feet, initial production 85 bbls. per hour through open tubing, total depth 3,594 feet. Lee Brothers' No. 1 School Lot, top sand 3,704 feet, initial production 75 bbls. in one-half hour through open tubing, total depth 3,706 feet. Tom Potter's No. 2 Anderson, top sand 3,501 feet, initial production 20 bbls. per day on air lift, total depth 3,536 feet. Tide Water Oil Co.'s No. 9 W. D. Lacy, top sand 3,562 feet, initial production 14 bbls. in 10 minutes through open tubing, total depth 3,562 feet. Utex Oil Co.'s No. 7 State, top sand 3,430 feet, initial production 150 bbls. per hour through open tubing, total depth 3,470 feet. Winston Oil Co.'s No. 8 Jones, top sand 3,686 feet, initial production 25 bbls. per hour through open tubing, total depth 3,689 feet.

North Rusk County

Devonian Oil Co. and Gulf Production Co.'s No. 29 Motley, top sand 3,708 feet, initial production 90 bbls. per hour through open tubing, total depth 3,721 feet. Humble Oil & Refining Co.'s No. 118 L. D. Crim, top sand 3,658 feet, initial production 180 bbls. per hour through open tubing, total depth 3,685 feet; No. 10 W. D. Peterson, top sand 3,563 feet, initial production 43 bbls. per hour through open tubing, total depth 3,577 feet; No. 23-B Sexton, top sand 3,590 feet, initial production 31 bbls. in one-half hour through open tubing, total depth 3,692 feet.

McMahon and McCullough's No. 10 S. S. Laird, top sand 3,641 feet, initial production 30 bbls. in one-half hour through open tubing, total depth 3,661 feet. Magnolia Petroleum Co.'s No. 6 W. M. Jernigan, top sand 3,668 feet, initial production 16 bbls. in five minutes through 1-inch tubing choke, total depth 3,735 feet; No. 7 Jernigan, top sand 3,641 feet, initial production 11 bbls. in five minutes through 1-inch tubing choke, total depth 3,700 feet. Neversuch Oil Co.'s No. 8 A. Givens, top sand 3,633 feet, initial production 25 bbls. in one-quarter hour through open tubing, total depth 3,667 feet. Sun Oil Co.'s No. 17 J. R. Beall, top sand 3,578 feet, initial production 59 bbls. per hour through open tubing, total depth 3,602 feet. Tide Water Oil Co.'s No. 3 C. E. Christian, top sand 3,666 feet, initial production 30 bbls. in one-quarter hour through open tubing, total depth 3,670 feet.

South Rusk County

Donley and Chastain's No. 2 Giles, top sand 3,681 feet, initial production 30 bbls. in one-quarter hour through open tubing, total depth 3,738 feet. Eastern Texas Petroleum Co.'s No. 2 W. L. Arnold, top sand 3,690 feet, initial production 30 bbls. in two hours, total depth 3,727 feet. Fair and Thompson's No. 3 Bradford, top sand 3,586 feet, initial production 35 bbls. per hour through open tubing, total depth 3,658 feet. Humble Oil & Refining Co.'s No. 9-A Barksdale, top sand 3,759 feet, initial production 67 bbls. per hour through three-quarters inch tubing choke, total depth 3,783 feet; No. 6 Barton, top sand 3,758 feet, initial production 61 bbls. per hour through open tubing, total depth 3,783 feet; No. 8 Shaw, top sand 3,717 feet, initial production 90 bbls. per hour through open tubing, total depth 3,721 feet; No. 9 C. W. Wilson, top sand 3,590 feet, initial production 26 bbls. in 45 minutes through open tubing, total depth 3,704 feet.

Hunt Production Co.'s No. 5-A Joe Lee, top sand 3,761 feet, initial production 30 bbls. in 10 minutes through open tubing, total depth 3,765 feet; No. 11 V. E. Reed, top sand 3,595 feet, initial production 20 bbls. in 16 minutes through open tubing, total depth 3,724 feet. Jenkins Oil Co.'s No. 16 Jobe, top sand 3,568 feet, initial production 100 bbls. per hour through one-half inch tubing choke, total depth 3,666 feet. E. W. and T. D. Jones' No. 5 W. P. Moore, top sand 3,649 feet, initial production 90 bbls. in one-half hour through open tubing, total depth 3,676 feet. Mid-Kansas Oil & Gas Co.'s No. 73 W. T. Grissom, top sand 3,640 feet, initial production 64 bbls. per hour through open tubing, total depth 3,645 feet. George B. Ray's No. 7 Goforth, top sand 3,802 feet, initial production 28 bbls. in 35 minutes through open tubing, total depth 3,805 feet. Jay Simmons' No. 1 Holland, top sand 3,647 feet, initial production 35 bbls. in one-half hour through open tubing, total depth 3,711 feet. E. Constantin, Jr.'s

(Continued on Page 31-R)

Completion Northwest of Old Lucas Gas Field May Open Play of Major Proportions

SAN ANTONIO, Tex., Aug. 20.—The bringing in of a well the past week by Lion Oil & Refining Co. in its P. E. McNeill wildcat, 3½ miles northwest of the old Lucas gas field in southeastern Live Oak County generally is being looked upon as one of the most important discoveries in Southwest Texas this year. While the well has not held up to early expectations, it is looked upon as the forerunner not only of a new field but also of another play of possible major proportions.

The well, 1,320 feet from the southwest line and 1,370 feet from the southeast line of the Jane Curry Survey, 3 miles east of Whitsett, was brought in August 15 and flowed at the rate of 10 bbls. an hour through a five-eighths inch choke for 24 hours, from 6 feet of sand at 4,370-76 feet. With the casing shut in the pressure built up steadily to a maximum of 800 pounds but began to fall off, dropping to 175 pounds.

On the following day production dropped to around 5 bbls. an hour, flowing by heads with no pressure on the tubing. The casing was opened to permit the well to blow but it quit flowing. The casing was closed in in an attempt to build up pressure again. On August 17, the casing pressure recorded 450 pounds but there still was no flow through the tubing. A little gas was showing but no pressure. Since then, operators have been swabbing but have been unable to make it flow naturally although Monday it was making about 140 bbls. daily. Preparations are being made to put it on air lift.

Little Attention to Possibilities

The sand from which the oil is coming is in the Hockleyensis zone of the Jackson, a horizon until now productive only at Raccoon Bend, in Austin County, some 200 miles northeastward up the coast. Little attention had been paid to the possibilities of production in this horizon, and for the most part it has been passed up by wildcatters in search of probable more prolific production in deeper sands in the Pettus zone, or its equivalent, the Cockfield of the upper Gulf Coast. That much of the territory along the trend between Raccoon Bend and the new discovery, as well as westward down the coast will be exploited for additional Hockley production is likely.

The oil in the Lion well tested 45 degrees (corrected for temperature), and a sample showed the following recovery: 45.2 per cent 56.9 gravity gasoline at a temperature of 410 degrees; 18.6 per cent 42.6 gravity kerosene at a temperature of 510 degrees; 35 per cent 31.4 gravity bottoms; 2 per cent loss.

The Lucas Field, the nearest production, is primarily a gas area, and although sands have been encountered at depths ranging from 875 to 5,500 feet, nothing has been obtained in the horizon from which the new well is completed. To date, although opened early in 1923, it has yielded only about 60,000 bbls. of oil from shallow sands, the oil being between 23 and 24 gravity.

Although the well is on a large block of acreage controlled by the Lion Oil & Refining Co., the location is near the south edge. Humble Oil & Refining Co. owns acreage within 1,000 feet of the well and also owns a half of the royalty under the well. Other companies having holdings in around the area are Magnolia Petroleum Co., Phillips Petroleum Co., Sinclair Prairie Oil Co. and Darby Petroleum Co. Stanolind Oil & Gas Co. has taken a spread around Lowrie & Young's block just south of Lion's block and on which a deep test is to be started before October. Others are now getting in the district and an active lease and royalty play is getting under way both ways along that trend.

Bruni Area

In the Bruni area or West Gole Field of Webb County, where the development of deep production in the Pettus sand horizon, the equivalent of the Cockfield, is in the making, United Production Co. and Cole Petroleum Co. still are trying to plug off water in their respective wells. The former has made four different attempts to cement off in its No. 1 Bruni, discovery well, and bottom now is 3,429 feet, where another test is waiting on cement to set. The hole had been drilled to a total depth of 3,444 feet with top of the sand at 3,410 feet, where a drill stem test showed oil and water. It was completed last July with bottom at 3,417 feet where it jetted about 60 bbls. daily of high gravity oil from sand at 3,410-13 and 3,414-17 feet.

Cole Petroleum Co.'s No. 85 Benavides, a mile north of the discovery, also has been unable to shut off water. It is bottomed at 3,422 feet. The water is claimed to be only slightly brackish and not unlike what generally is referred to in that area as fresh water, there being no strictly fresh water in that country. This well was completed flowing 250 bbls. of fluid, 60 per cent water. It first was thought there was a leak in the casing and that the water was not from the bottom.

In the meantime there is no lack of interest in the area. United Production Co.'s No. 2 Bruni, 800 feet to the north of No. 1 Bruni, discovery well, continues to produce pipe line oil, making around 400 bbls. daily pinched to a three-sixteenths inch choke and showing a pressure of 650 pounds on the tubing and 1,250 pounds on the casing. It has the sand at 3,396-3,421 feet.

O. W. Killam is ready to start drilling on his No. 26 Bruni, 660 feet southwest of Cole's No. 85 Benavides, and also on No. 25 Bruni, a little east and south of the discovery. A mile east of Bruni, Klamor Production Co. has rigged up No. 1-B Bruni estate, to be drilled to the deep horizon.

Angelita Field

In the recently opened Angelita Field of San Patricio County, Atkins & O'Neil and Continental Oil Co. has been unsuccessful in their attempt to shut off water in their No. 2 Welder. After plugging back 2 feet from its former total depth, the well came in flowing 100 bbls. of fluid, of which 97 per cent was water and 3 per cent oil, through an eighth-inch choke on the tubing with pressure of 800 pounds. It is probable the hole will be drilled deeper in exploration of lower horizons. As a result of the showing in this well, and the abandonment last week of the same operators' No. 1-A Welder at 6,003 feet, the general opinion is now that the field will not be of any major importance although some small production may be developed.

Hidalgo County

Davis & Harrison are preparing to drill plug in their Lula George wildcat in southwestern Hidalgo County and expect to test Tuesday or Wednesday the gas sand found at 4,109-35 feet. It has been standing cemented at 4,090 feet following a drill stem test which showed 1,800 pounds pressure. While the drill stem test was being attempted, the well blew out and ran wild for six hours before being killed by pumping mud into the hole. It is general opinion this well is opening a new field of considerable extent. Leasing is going on throughout the county. Among those active is San Oil Co., which is taking a spread of some 17,000 acres in the Santa Anita grant, north of Monte Cristo, in the northwestern part of the county, and about 3,000 acres in the Salvador Del Tule grant between Edinburg and the north line of the county.

In the eastern part of the county, Union Sulphur Co.'s No. 2 American Rio Grande, Block 86, North Capisallo district, is making fast hole and was drilling below 3,960 feet. This test is to go at least to 5,500 feet, one of the few deep tests drilled in the county.

West Tuleta Area

The new West Tuleta area in north central Bee County has the promise of another good producer in Leslie McKay and associates' No. 1 Mrs. William Rapp, 1,650 feet from the east and south lines of Section 5, Uranga Survey, which in a nine-minute drill stem test in the Pettus sand at 3,900-12 feet showed 325 pounds working pressure through a quarter-inch choke on bottom and a five-sixteenths inch choke on top, and recovered 30 feet of oil. It has been standing cemented but preparations now are being made to drill in and run screen.

This will be the four producer in the area, and follows the bringing in of Walton & Heard's No. 1 Rapp, completed last week as the best well of the field, and which topped the Pettus sand at 3,906 feet, drilling to a total depth of 3,913 feet. It flowed 19 bbls. an hour through a half-inch choke. The latter operators have rigged up for their second test, No. 1 Rapp; Dirks Brothers, whose No. 1 Skinner opened the area, have started their second test, one location north of the discovery, while E. M. Jones' No. 1 Robinson, an offset to the discovery, is drilling shale at 2,615 feet.

Caesar District

In the Caesar district, northwestern Bee County, Caesar Oil Co.'s No. 1 Pullin Estate, F. Lewis Survey, has been completed as a gasser with 1,150 pounds pressure on the tubing and 1,250 pounds on the casing, and being at 3,030-44 feet. Houston Oil Co.'s No. 4-B Neihaus, Tally Survey, North Pettus Field, Bee County, is testing sand at a total depth of 3,650 feet and showing for a producer. It recovered 140 feet of oil on a drill stem test a couple of weeks ago.

R. H. Feltner and associates' No. 1 Theis, Caetano, 9 miles northwest of Beeville, a rank wildcat, has been abandoned as dry at 4,510 feet. This test had the Pettus sand at 4,220-65 feet but with nothing in it. Weekly Oil Corp. has been unsuccessful in its attempt to make a drill stem test of the Pettus sand, found at 4,200-10 feet, in its No. 1 Laura Weiss, a wildcat 4½ miles southeast of Pettus.

San Patricio County

Also in San Patricio County, Jane Oil Co.'s No. 1 Ragsdale, Section 58, George H. Paul Subdivision, near Gregory, has been abandoned as dry after drilling to 6,011 feet. It topped the Discorbis at 5,049 feet and the Heterostegina at 5,347 feet. Marland Oil Co. of Texas' No. 1 Micalastic, Section 6, George H. Paul Subdivision, near St. Paul, is drilling below 5,000 feet. Beasley & Price's No. 1 L. R. Sadler, Block 1, Section 32, Taft Farms, was drilling lime and shale at 5,385 feet at latest report. In the Sinton area, Heep Oil Corp.'s No. 3 R. Welder, Loupey Survey, was coring hard sand below 5,990 feet. Petrol Corp.'s

Osage Lease Sale Scheduled for Sept. 18 Protested by Lessees Association

Unless it is called off on the protest made by the Osage Oil Lessees Association, an auction sale of leases in Osage County, Oklahoma, will be held in Pawhuska, Okla., on Tuesday afternoon, September 18.

Among the tracts to be offered are some in the South Burbank area, close to leases of big production.

Following are the parcels of land listed:

Tr.	Description	Acres
1	SE 17-22-12	160
2	SW 17-22-12	160
3	NW 18-22-12	160
4	NE 20-22-12	160
5	NW 20-22-12	160
6	SE 19-26-12	160
7	NW 13-21-11	160
8	NE 14-21-11	160
9	NE 6-22-11	160
10	NW 9-22-11	160
11	SW 28-22-11	160
12	NW 33-22-11	160
13	SE 33-24-11	160
14	NW 29-26-11	160
15	NW 21-27-11	160
16	NE 30-28-11	160
17	NW 4-20-10	160
18	SW 4-20-10	160
19	NW 13-21-10	160
20	NE 20-21-10	160
21	NW 20-21-10	160
22	NW 18-22-10	160
23	SW 18-22-10	160
24	SE 32-22-10	160
25	SE 30-24-10	160
26	NE 31-24-10	160
27	NW 31-24-10	160
28	SE 25-28-10	160
29	NE 36-28-10	160
30	SE 36-28-10	160
31	SE 28-21- 9	160
32	NE 33-21- 9	160
33	NE 5-22- 9	160
34	SE 30-22- 9	160
35	NE 31-22- 9	160
36	NW 31-22- 9	160
37	SE 26-25- 9	160
38	NW 29-25- 9	160
39	NE 34-26- 9	160
40	SE 34-26- 9	160
41	NE 15-21- 8	160
42	Fr. NW 14-21- 8	28
43	SE 14-22- 8	160
44	NW 30-22- 8	160
45	SE 30-22- 8	160
46	SW 30-22- 8	160
47	SW 9-24- 8	160
48	NE 28-24- 8	160
49	NW 28-24- 8	160
50	NE 10-25- 8	160
51	NW 11-25- 8	160
52	NE 27-25- 8	160
53	NW 27-25- 8	160
54	SE 27-25- 8	160
55	NE 13-22- 7	160
56	SE 13-22- 7	160
57	SE 24-22- 7	160
58	SW 9-24- 7	160
59	NE 25-25- 7	160
60	SE 25-25- 7	160
61	SE 30-25- 7	160
62	NE 32-26- 7	160
63	SE 32-26- 7	160
64	NW 33-26- 7	160
65	SW 33-26- 7	160
66	NE 13-23- 6	160
67	SE 13-23- 6	160
68	SE 4-24- 6	160
69	SW 4-24- 6	160
70	NE 9-24- 6	160
71	NW 9-24- 6	160
72	SW 22-24- 6	160
73	NE 27-24- 6	160
74	NW 27-24- 6	160
75	SE 4-25- 6	160
76	SW 7-26- 6	160
77	NE 16-25- 6	160
78	SW 31-25- 6	160
79	SE 34-26- 6	160
80	SW 35-26- 6	160
81	SW 7-24- 5	160
82	NW 18-24- 5	160
83	SE 12-24- 4	160
84	NE 13-24- 4	160
85	NW 13-26- 4	160
86	NE 14-26- 4	160
	Total acreage	13,628

No. 1 R. Welder, same area, and west of Plymouth Oil Co.'s producer, at latest report was coring at 5,425 feet.

Nueces County

Stanolind Oil & Gas Co.'s No. 2 Stratton, De Abajo grant, deep wildcat in Nueces County, is drilling hard sand at 6,275 feet after an unsuccessful drill stem test of a sand at 6,170-6,215 feet. Texas-Seaboard Oil Co.'s No. 1 E. Jurica, Rincon del Oso grant, Block 32, another Nueces wildcat being watched closely, is drilling shale below 5,482 feet. A new deep wildcat is being started by the Bluff Petroleum Co., No. 1 Vincent Bluntzer, 660 feet from the north and east lines of Share 7, Bluntzer Subdivision.

Duval County

Continental Oil Co.'s No. 2-A Driscoll Estate, Section 448, Driscoll Field, Duval County, cored dry sand at 4,685-95 feet and is being plugged back to test sands passed up. It had encountered three definite sands, one at 2,498-2,511 feet, which showed oil and water; another at 3,518-25 feet, which showed gas, and a third at 3,601-25 feet, which also showed gas.

Sun Oil Co.'s No. 1 C. Moreno, deep wildcat 5 miles south of San Diego, Duval County, topped the Diboll around 6,200 feet, and now is drilling at 6,600 feet.

Guadalupe County

Diamond Half Oil Co.'s No. 1 A. J. Ball, L. H. Peters Survey, a wildcat in Guadalupe County, topped the Del Rio at 2,304 feet and the Georgetown at 2,330 feet and at latest report was drilling Georgetown lime at 2,335 feet.

East Texas Fields

(Continued from Page 29-R)

No. 1 Watkins, top sand 3,601 feet, initial production 20 bbls. in two hours' pumping, total depth 3,621 feet. Stanolind Oil & Gas Co.'s No. 3-A Schuler, top sand 3,615 feet, initial production 20 bbls. in 50 minutes through open tubing, total depth 3,690 feet. Stone-Wells' No. 1 Stone, top sand 3,645 feet, initial production 30 bbls. in one-half hour through open tubing, total depth 3,665 feet. Sun Oil Co.'s No. 4-A R. A. Barksdale, top sand 3,765 feet, initial production 65 bbls. per hour through open tubing, total depth 3,782 feet. Texas Co.'s No. 13 First State Bank, top sand 3,696 feet, initial production 75 bbls. per hour through open tubing, total depth 3,736 feet; No. 14 Kirsch, top sand 3,624 feet, initial production 70 bbls. per hour through open tubing, total depth 3,627 feet. Woodley Petroleum Co.'s No. 2 M. M. McMillan, top sand 3,731 feet, initial production 35 bbls. in one-quarter hour through open tubing, total depth 3,746 feet.

Smith County

Alex McCutcheon's No. 3 T. Stone, top sand 3,766 feet, initial production 30 bbls. in 20 minutes through open tubing, total depth 3,768 feet. W. H. McMurray's No. 9 G. A. Turner, top sand 3,814 feet, initial production 90 bbls. per hour through open tubing, total depth 3,829 feet. J. S. Wheelis' No. 3 H. J. Patterson, top sand 3,718 feet, initial production 60 bbls. per hour through open tubing, total depth 3,719 feet.

Upshur County

Conservative Oil Co.'s No. 14 Victory, top sand 3,696 feet, initial production 60 bbls. per hour through open tubing, total depth 3,698 feet. Eastern Texas Petroleum Co.'s No. 1-A H. S. Ray, top sand 3,600 feet, initial production 20 bbls. in one-quarter hour through open tubing, total depth 3,605 feet; No. 26 D. F. Smith, top sand 3,580 feet, initial production 20 bbls. in one-quarter hour through open tubing, total depth 3,589 feet. Gilliland Refining Co.'s No. 2 A. J. Sanders, top sand 3,616 feet, initial production 15 bbls. per hour through open tubing, total depth 3,630 feet. Humble Oil & Refining Co.'s No. 28 Edwards, top sand 3,684 feet, initial production 41 bbls. per hour through open tubing, total depth 3,689 feet. E. L. Smith's No. 6 E. A. Watts, top sand 3,597 feet, initial production 20 bbls. in 18 minutes through open tubing, total depth 3,607 feet. Twin Oil Co.'s No. 3 Mackey, top sand 3,720 feet, initial production 8 bbls. per hour through open tubing, total depth 3,726 feet. Joe Zeppa's No. 6 Victory, top sand 3,680 feet, initial production 15 bbls. in one-quarter hour through open tubing, total depth 3,692 feet.

(Cayuga Pool) Anderson County

Stanolind Oil & Gas Co.'s No. 1 Loper, location abandoned; No. 1 Tubbs, top sand 4,071½ feet, initial production 15 bbls. per hour pumping, total depth 4,088 feet. Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 1 Bowyer, top Woodbine sand 3,878 feet, total depth 4,111 feet, plugged back to 3,965 feet and completed as gas well; No. 6 Edens, top Woodbine sand 3,852 feet, top gas sand 3,922 feet, initial production 16 bbls. per hour through three-sixteenths inch tubing choke, total depth 4,050 feet. Tide Water Oil Co.'s No. 1 J. A. Ware, top sand 3,873 feet, top oil sand 4,070 feet, initial production 94 bbls. in 24 hours through seven-sixty-fourths inch tubing choke, total depth 4,090 feet.

WILDCAT COMPLETIONS

Anderson County

Canadian Production Co.'s No. 1 R. M. Jackson, top Pecan Gap 2,947 feet, base 3,005 feet, top Austin chalk 4,080 feet, base 4,335 feet, top Woodbine sand 4,796 feet, tested 2,200 feet of salt water from 4,790-4,863 feet, dry and abandoned, total depth 5,102 feet, W. C. Caldwell Survey.

Cherokee County

T. J. Wood and others' No. 2 New Birmingham Development Co., top Pecan Gap 3,998 feet, base 4,442 feet, top Austin chalk 4,895 feet, base 5,122 feet, dry and abandoned, total depth 5,163 feet, Levi Jordan Survey.

Freestone County

Trinity Farm Co.'s No. 1 M. P. Stewart, top Pecan Gap 2,195 feet, base 2,331 feet, top Austin chalk 3,218 feet, base 3,575 feet, top gas sand 3,932 feet, top Woodbine sand 3,888 feet, initial production 10,000,000 feet of gas, total depth 4,045 feet, plugged back to 3,975 feet.

Upshur County

Ben G. Barnett and others' No. 1 W. S. Jones, top Austin chalk 3,600 feet, base 3,707 feet, top sand 3,728 feet, dry and abandoned, total depth 3,731 feet.

West Texas Fields

(Continued from Page 28-R)

Texas Co.'s No. 3 Cuba, dry and abandoned, total depth 1,415 feet. R. C. Parker's No. 1 Mattoch, dry and abandoned, total depth 701 feet. Texas Co.'s No. 1-B McCrary, dry and abandoned, total depth 1,624 feet.

Montague County

Continental Oil Co.'s No. 1 Lawler, oil sand 1,708-18 feet, initial production 300 bbls., total depth 1,718 feet.

Wichita County

J. E. Keeler's No. 2 Burnett, dry and abandoned, total depth 800 feet.

Wilbarger County

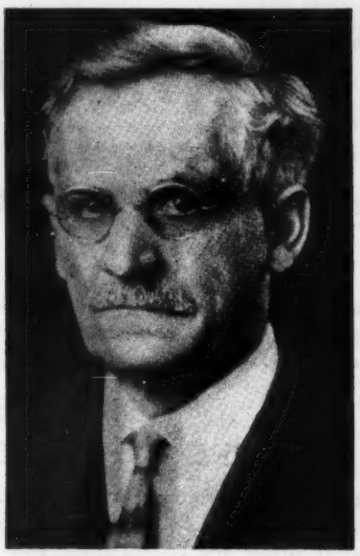
Consolidated Oil Co.'s No. 6-T Waggoner, oil sand 1,862-88 feet, initial production 300 bbls., total depth 1,888 feet; No. 8-T Waggoner, oil sand 1,888-1,901 feet, initial production 300 bbls., total depth 1,901 feet. Phillips Petroleum Co.'s No. 2 Anna-Waggoner, lime 2,552-86 feet, initial production 1.5 bbl. of oil and 15 bbls. of water, total depth 2,586 feet. A. B. Wharton, Jr.'s No. 4-A Waggoner, oil sand 1,865-78 feet, initial production 200 bbls., total depth 1,878 feet; No. 5-A Waggoner, abandoned location.

Young County

Tom McDavid's No. 1 Hamilton, dry and abandoned, total depth 1,000 feet. L. J. Wright and others' No. 1 Lesley, oil sand 892-99 feet, initial production 15 bbls., total depth 899 feet. C. E. Beavers' No. 3 Montgomery, oil sand 712-22 feet, initial production 108 bbls., total depth 722 feet; No. 2 Montgomery, oil sand 607-15 feet, initial production 70 bbls., total depth 615 feet; No. 1 Montgomery, oil sand 705-10 feet, initial production 150 bbls., total depth 710 feet.

Expert in Devising Tools to Meet Special Problems

Inventive genius, combined with practical experience and the ability to develop tools that will meet the problems confronting the oil operator are factors



R. C. BAKER

that have made R. C. (Carl) Baker an outstanding figure among manufacturers of oil equipment. But it was his ingenuity in meeting his own problems as an operator and drilling contractor and his willingness to apply his ability and experience to the solution of the problems of others that establishd his position in the oil industry. He is known for his ability to visualize well conditions. He has been particularly successful in extracting troublesome "fish" and he has earned a reputation for devising ways for shutting off water by the use of special cementing devices.

Mr. Baker was one of the first operators to use the rotary methods in California. He brought in two rotary outfits and two rotary drilling crews from Texas in 1907 and he still has cores taken with a rotary core barrel which he devised at that time. He early realized the importance of cement and was considered a cementing expert long before 1910. In fact, many of his special cementing tools were devised between 1910 and 1915.

Born in Virginia in 1872, Reuben Carlton Baker moved to northern California with his parents at the age of three. Here he lived until 1893, when he considered whether to go to Alaska or to some new oil fields being developed at Los Angeles. He decided on the latter and has been connected with the oil business ever since.

During many years, Mr. Baker confined his activities to contracting and producing in the fields around Los Angeles and Coalinga, Calif., and in Wyoming. He was continually working on improvements in methods and equipment. In 1902 be obtained a patent on an offset bit.

In 1907 he was superintendent for the Inca Oil Co., the Nathan Oil Co. and the Coalinga Petroleum Co. on the well-known Liza Jane lease. He was then placed in charge of the American Petroleum Co., which later became the California Petroleum Co. In the same year he developed his casing shoe which has become known by cable tool drillers throughout the world. The Baker Casing Shoe Co. was incorporated in 1913. By 1921 the business of the company had increased to such an extent that a factory, warehouse and general office were opened in Huntington Park, Calif. A Mid-Continent office and warehouse were established in Tulsa in 1924 with the B. & A. Specialty Co. Then in 1927 a company branch office was opened in Houston, Tex.

The name of the company was changed to Baker Oil Tools, Inc., January 1, 1929, with Mr. Baker president. While the offices of the company are in Huntington Park, Calif., Mr. Baker still lives in Coalinga.

Texas Case Dismissed When Commission Modifies Order

(Continued from Page R-13)

surveying all questionable locations for which applications for permits have been made for tests, that are exceptions to the spacing rule, but a trip through the field shows considerable town lot drilling.

Revising Federal Forms

WASHINGTON, D. C., Aug. 20.—Several prominent Texas lawyers are at present in Washington working with the Petroleum Administrative Board on changes in the recently published forms for enforcing the revised "hot" oil regulations. The group is headed by R. D. Parker and John Kilgore of the Texas Petroleum Council. Headway is being made in their attempts to make of these affidavits a more dangerous weapon than they now are, although, it has been said that at the present time the report forms are almost "fool-proof."

The changes which have been recommended involve the simplifying of the reports so they may more readily be tabulated by the Bureau of Mines statisticians who will analyze them. One of the principal changes, it is believed, will be in the "Producers' Report." Because of the practical impossibility of the producers being able to make a daily report, as required at the present time, that part requiring a daily check-up will probably be eliminated. It is not known what other changes have been suggested, but officials say the finished product will be a very workable and enforceable system of reports.

Despite the fact it is generally believed these new regulations face a severe court test when attempts are made to enforce them, it is maintained by members of the Petroleum Administration this will not happen. It has been said the decision of the Fifth Circuit Court of Appeals at New Orleans in the Panama and the Amazon cases obviates the possibility of any court action.

Compliance Director Russell B. Brown is quietly going about his job of encouraging compliance with the provisions of the code. He is actively co-operating with the Department of Justice and the Division of Investigations of the Department of Interior. As a result, suits for violations of the code have been filed in five states, Virginia, Arkansas, Tennessee, Georgia and Mississippi.

Besides these cases which have been formally docketed district attorneys in all parts of the country have before them for the preparation of the necessary legal documents over 300 charges of violations. Action on these will be taken in the very near future. It is believed this show of action by the Department of Justice will have a very salutory effect upon compliance with the code. All of the alleged violations being considered by the various district attorneys cover marketing and labor provisions of the code, the majority being violations of the marketing provisions.

NEW LABORATORIES FOR GULF

PITTSBURGH, Pa., Aug. 20.—Work was begun Tuesday on three buildings at Harmarville, Pa., in which the Gulf Oil Co. will house new laboratories. All research work will be concentrated here. The project will cost about $400,000. Occupancy is scheduled for next January 1.

TITUSVILLE IRON WORKS

America's pioneer manufacturer of oil field machinery

Founded in 1860 within a year and a mile of the first Drake Oil Well, the Titusville Iron Works enjoys the unique distinction of being the first plant devoted exclusively to the manufacture of oil field machinery. Here was originated a famous line of Gas Engines,—forerunners of the original Tico Convertible Oil and Gas Engines of today, culminating in the

TICO 12½" x 16"
TYPE C FULL DIESEL ENGINE

. . . the last word in modern oil field engines . . . built expressly for the heaviest service demands of today . . . incorporating the efficient and economical advantages of FULL DIESEL design with an exceptionally strong and rugged frame that gives perfect stability under all stresses and strains . . . guaranteed to be free from all vibrations. For your heaviest service demands, we urge you to investigate this remarkable engine . . . backed by 74 years of progressive improvements.

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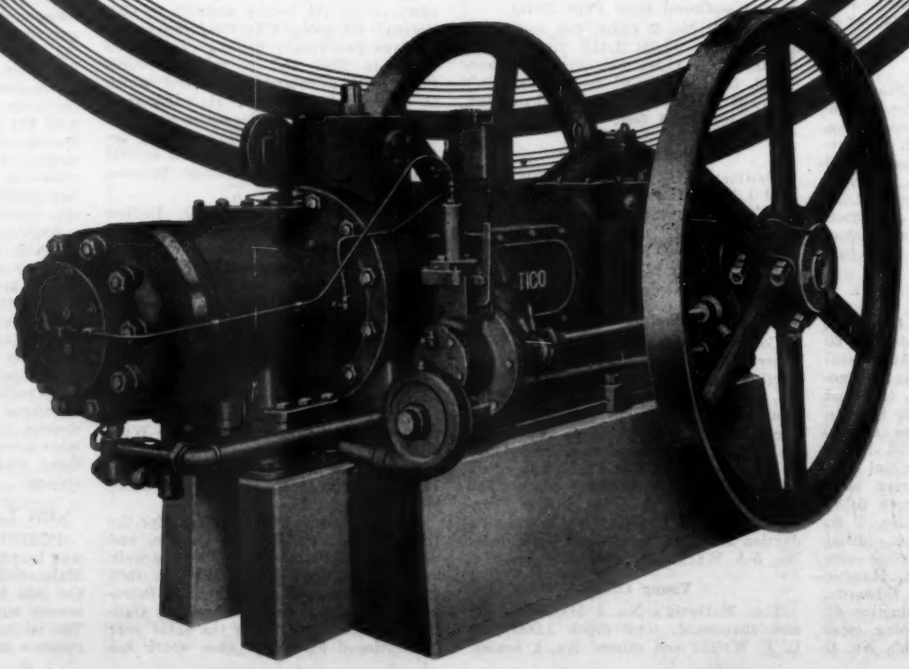


E. L. Drake

FOUNDER OF THE OIL INDUSTRY, BECAME A PENSIONER OF STATE

EDWIN LAURENTINE DRAKE, who drilled the first commercial oil well and thus was the founder of an industry representing billions of invested capital, was born March 29, 1819, on a farm near Greenville, N. Y. He died in Bethlehem, Pa., November 8, 1880, in poverty, a pensioner of the State.

Edwin and a brother were the only children and while they were young boys the family moved to Castleton, Vt. After receiving a district school education and working about the farm till he was 19, Edwin started for Michigan, where an uncle resided, intending to find work there. He had reached Buffalo, N. Y., on his way West, when he got a job as night clerk on a steamboat running between that city and Detroit, Mich. With the close of lake transportation for the season he left the boat at Detroit and went to his uncle's home near Ann Arbor. Obtaining work on a farm, he remained for a year. Two years as a hotel clerk in Tecumseh, Mich., followed.

Going back to Vermont to visit his parents, Edwin was prevailed upon to remain in the East. He obtained employment as a salesman in a drygoods store in New Haven, Conn. At the end of three years he gave up this job and went to New York, where he got work as a salesman in a Broadway drygoods store. He married a young woman from Springfield, Mass., and becoming ill soon afterward he gave up his position. With his wife he went to Springfield, where rest restored his health. Offered a position as express agent on the Boston and Albany Railroad at $50 a month, he accepted it, continuing in this work till 1849, when he quit to become a conductor on the New York & New Haven Railroad, just completed. He kept this railroad job until 1857, in which year he became associated with a group of men interested in a project for the recovery of surface petroleum on land near Titusville, Pa., by digging a system of trenches. These men had organized the Pennsylvania Rock Oil Company.

Wonder often has been expressed how a man whose training had been so remote from engineering activities came to be the driller of the world's first oil well. Here is the explanation:

Sent to Investigate

Mrs. Drake died in 1854. This broke up the little home in New Haven and young Drake began boarding. While residing in the Tontine Hotel in New Haven he met James M. Townsend, a New Haven banker and president of the Pennsylvania Rock Oil Company. Things were not going well with the company. Mr. Townsend persuaded the young railroad conductor to invest $200 (his balance in the bank) in Pennsylvania Rock Oil stock, parting with some of the 500 shares which he himself held. Shortly thereafter Mr. Townsend engaged Mr. Drake to go to Titusville and investigate the oil prospects there. Mr. Drake's report was enthusiastic and the drilling venture on Watson Flats was the outcome.

Before Mr. Drake even reached Titusville mail was waiting for him there addressed to "Col. E. L. Drake." This had been sent by Mr. Townsend, who was alive to the advertising value of a military title. The "colonel" stuck to Mr. Drake throughout the rest of his life.

Three years after the death of his wife, Colonel Drake married Miss Laura Dow, of New Haven. In the spring of 1858 Colonel and Mrs. Drake, with their two children (one by the first wife), arrived in Titusville, Colonel Drake having been engaged by the Seneca Oil Company, operating subsidiary of the Pennsylvania Rock Oil Company, to supervise operations for the recovery of petroleum. He was provided with $1,000 to start with and his contract called for $1,000 a year salary Days of adversity and of financial worry followed.

When townsfolk in May, 1859, saw a derrick built and then saw the man from New England directing the drilling of a hole through rock with the idea that he would reach oil they ridiculed him and called the enterprise "Drake's Folly." Colonel Drake was unmoved. His money became exhausted and the men in the East to whom he looked for financial support were slow to send more. A few men in Titusville who believed in him and in his theory advanced enough to avoid abandoning the undertaking.

Colonel Drake's faith was vindicated in August, 1859, when he struck oil, bringing to a triumphant conclusion an experiment which was to revolutionize man's way of living and doing things; which was to cause towering derricks to sprout from farm, woods and sandy desert; which was to build cities and dot the seas with ships; which was to create prodigious fortunes and set the spirit of adventure aflame.

The countryside was electrified by the news of the Drake well; but while other men scrambled to gain such advantages as they might by forehandedness Colonel Drake himself, failing to realize the importance of his discovery, made no move.

Elected Justice of the Peace

Colonel Drake, who might easily have acquired a fortune, extended his actual participation in oil drilling operations little beyond the discovery well. In 1860 he was elected a justice of the peace in Titusville. The income from this office was about $3,000 a year, since there was great activity in the buying and selling of oil leases and oil lands and he drew up and signed most of these conveyances. At the same time he bought oil for a New York firm and the commissions on this business increased his earnings to about $5,000 a year. He purchased 25 acres of ground from Jonathan Watson, and Drake Street, Titusville, a residential thoroughfare, named after him, traverses the middle of this tract. There was a mortgage on the property and Colonel Drake later was compelled to sell it. Records indicate he made no profit out of this venture in real estate.

In 1863 Colonel Drake left the oil country, never to return to it. He is estimated to have had about $15,000, with which he bought a partnership in a Wall Street firm in New York dealing in oil shares. Unfortunate speculation soon wiped out his savings.

Left without a cent and suffering from a breakdown which threatened to end fatally, Colonel Drake, with his wife and four children went back to the old home in Vermont, the expenses of the trip being met with money which Mrs. Drake had managed to earn and save. A neuralgic affection of the spine settled upon him. Mrs. Drake bravely assumed the task of caring for the invalid and of maintaining the family by sewing.

A physician having advised the sick man to go where he would have the benefit of sea air, a friend of the family offered the use of a cottage near Atlantic Highlands, N. J. The offer was accepted. In the new home Mrs. Drake encountered great difficulty in providing sufficient food for the family. Later the family moved to the nearby village of Chapel Hill.

In desperation Colonel Drake dragged himself to New York, "hoping to be able to find a position for his oldest boy among the friends he had known in the days of his comparative prosperity." In the street there he met "Zeb" Martin, of Titusville, who noting the other's run-down appearance, drew from him his story of misery. The man who had opened the way for hundreds of others to gain riches admitted that he was hungry and destitute. Mr. Martin bought him a dinner, gave him $20 and assured him that help soon would be forthcoming from old friends in the oil regions.

On his return to Titusville Mr. Martin called a public meeting in Corinthian Hall and there told of Colonel Drake's plight. In a short time a relief fund of $4,200 was raised. This money was placed in the hands of Mrs. Drake, who had proved herself a wise and frugal manager. The interest (she kept the principal intact so far as possible) lightened the load on her shoulders.

Annuity Granted by Legislature

Help for the stricken family did not stop with private contributions. The Drakes moved to Bethlehem, Pa., early in the seventies and the Pennsylvania legislature passed an act granting an annuity of $1,500, which was paid to Colonel Drake until his death and then to Mrs. Drake throughout the rest of her life. This removed the more serious of their financial worries. The annuity was authorized in recognition of the fact that the Drake discovery had "greatly stimulated various industries" and "added directly to the revenues of the commonwealth."

Death probably robbed Colonel Drake of a congressional appropriation of a quarter-million dollars in appreciation of his epochal achievement. The story was told as follows by the Petroleum Monthly:

"A short time before the death of that eminent statesman, Thad. Stevens he in conversation with a friend was discussing the magnificent extent of the petroleum trade in the United States when Mr. Stevens abruptly asked, 'What has become of Mr. Drake, the fellow who discovered this oil? I have heard he made a great fortune out of it.'

"His friend replied, 'I have had the honor of an intimate acquaintance with Colonel Drake and am sorry to say that, far from making a fortune out of his search for oil, he lost not only his money but his health also.'

"Mr. Stevens became at once deeply interested in the matter, and asked for a history of the colonel and the facts connected with his labors on Oil Creek before his final success. When it transpired that the colonel was living in obscurity and want the indignation of the old man was violent. 'What,' said he, 'can it be possible that this man is allowed to want for anything—this man who has done more for our state than any other since the days of Penn? This is the most damnable ingratitude I ever heard of.'

State Declared Debtor

"His companion remarked that the oil men of Pennsylvania should take care of Mr. Drake.

"'No sir,' said Mr. Stevens. 'They have no right to take care of Colonel Drake. They risk their money and deserve their riches if they gain any. The State, sir, should take care of the man, and good care, sir, too—good care, sir. If I were in the Pennsylvania legislature I would never rest until they had given him a sum in keeping with the wealth and dignity of the commonwealth, and if justice can be done he will get it.'"

Shortly afterward, August 11, 1868, Mr. Stevens died. Among his papers was found a bill ready for presentation to Congress, appropriating $250,000 for the relief of Colonel Drake, who was referred to as "a benefactor of his race." As Mr. Stevens up to the time of his death was the recognized leader of the House of Representatives it is believed the bill would have been passed.

In Woodlawn Cemetery, Titusville, is a beautiful monument, gift of the late Henry H. Rogers, of the Standard Oil Company, marking the last resting place of Colonel and Mrs. Drake. The body of Colonel Drake, buried first in Bethlehem, Pa., was moved later to the Woodlawn Cemetery. The monument was unveiled October 4, 1901, with ceremonies in which leading citizens took part.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

DISCOVERY OF OIL LIGHTED DARKNESS, SPEEDED UP WORLD

NOTHING man has taken from the earth has changed human life so quickly and so extensively as petroleum.

Gold, sought through the ages, is but a dead metal, an inanimate token for other things, goods and services, for whose utility it can offer in itself no substitute.

Oil, on the contrary, is alive, pulsing with living power capable of being harnessed by man for a thousand beneficial purposes.

The discovery of gold in California and Alaska enriched but a comparatively few. The discovery of oil lengthened the days and widened the horizon of mankind.

The most marvelous of our surroundings are often treated as the most commonplace. Wireless, the airplane, the motor car. We see or we use them every day and think no more about them than the air we breathe or the water we drink which we have had always.

Yet thousands now living can easily recall when these modern conveniences were undreamed of, when Langley's flying machine was laughed to scorn and steam rollers had to be preceded down the road by a man with a red flag.

So slow is the world to recognize the possibilities of something beyond its experience. They had been finding oil in salt wells for years and salt men complaining about the nuisance of it. Later the oil producers were complaining about the nuisance of gasoline and the difficulty of disposing of it. Yet this despised fluid has become, it has been said not irreverently, "God's greatest gift to man," next to water.

The pioneer oil men who flocked to Titusville could have no conception of what they were doing for the world. They naturally could see no further than possible personal gain. They could not even realize that the market for their oil was so limited at that time that each additional well completed was sending down the price. They would have been astounded could they have foreseen that the oil selling for $20 a barrel would within two years sell for ten cents a barrel.

Consider living conditions at that day. The railroads had not yet entered the oil region. The stage coach, the covered wagon and the canal boat were not yet outdated. A 12 or 15-mile trip to the county town in many sections meant getting up at daybreak, having the women cook a noonday meal in the square and return by nightfall. Thanks to the discovery of oil 12 or 15 miles today is practically next door.

Age of Whale Oil

When John D. Rockefeller was young, a biographer says, "a candle burning in a cottage, the sound of horse's hoofs upon a dirt road, the muffled thump of the water wheel at the mill represented the light, power and transportation of America." And to a great extent this was still true when oil was discovered. Some of the streets in the larger Eastern cities were lit by gas but the country as a whole depended on lamps and candles for the brief period between dark and bedtime.

The Argand burners and glass chimneys burning whale oil were reserved for the well to do. The whale was the basis of the country's oil industry, centering around Boston, and supplying the fats for candles used everywhere. Coal oil had become the lamp illuminant by the time oil was discovered but it cost a dollar a gallon. In those days of enforced thrift the cost of lighting gave added point to the adage about "early to bed and early to rise" making one healthy, wealthy and wise.

The discovery of oil and the advent of kerosene supplanting costlier lighting made possible longer days. The world ceased "going to bed with the chickens" and began to enjoy its evenings. An extra hour of leisure for improvement or entertainment was an inestimable boon in those days of scant opportunities for either.

It must rather shock modern America to realize that in the kerosene age the big market of the world was Europe. Our own population was not yet 40,000,000, we had not yet struck our industrial stride, and our buying power was small compared to the wealth centered in Europe. American products were somewhat sceptically viewed abroad, with some of the Connecticut nutmeg flavor, clever, of course, but not so dependable, you know. But American kerosene made its way, not only in Europe but in Asia and Africa and Australia until travelers began reporting having seen American oil cans in the remotest parts of the earth, in Tibet and Timbuctoo.

Meanwhile no one suspected that the lighter fractions, considered a nuisance and stealthily dumped into the creek, would some day create a still larger market for American oil.

In 1879 George B. Selden filed a patent on a device for driving a vehicle by an internal combustion engine. Otto, a German, had invented a four-cycle internal combustion engine in 1876, and a few years after Selden's application, (Daimler), another German, perfected an ignition system. Carl Benz, two years later, built a car that was actually driven by gasoline. In 1893 George Duryea, its inventor, drove the first American automobile along the streets of Chicopee Falls, Mass. The horseless carriage had arrived.

Even then no one imagined the development that was to come. A generation accustomed to walking, riding the horse, cable or new trolley cars to and from work, occasionally indulging in the luxury of a buggy ride and viewing a railroad journey as more or less of an event, regarded the horseless vehicle first as a freak and then as merely a potential successor to the family carriage to be enjoyed only by the wealthier.

Beyond Imagination

Stocks of railroads and electric railways were gilt-edged investments. Who could imagine that the new invention would threaten the profits of the one or drive the other off the streets for lack of patronage? Had anyone predicted that Tom, Dick and Harry would be driving to and from work in one of these contraptions, that the entire family one day would board "the old bus" and set out across the continent the prophet would have been rushed to the asylum.

Even the oil industry, intent upon its kerosene market, had no inkling of what was to come until it was upon it. The early motorist got his gasoline where he could, at the corner grocery or wherever he found it.

The early automobile races drew crowds in the grisly expectation of seeing somebody get killed. Every outing was an adventure. You might get there but you might not get back. The multitude of things that could go wrong with one of those early cars was infinite.

But the number of cars increased and their quality improved. Their cost, too, came down. Venturesome people who accepted an invitation to ride never got over wanting one of their own until they managed it.

About this time we had our little difficulty with Villa and General Pershing took what was probably our first army on trucks into Mexico. A little earlier General Gallieni had assembled the garrison of Paris on the taxicabs of that city and driven out to help repulse the invaders.

But before that we had a half million cars in the United States. Gasoline was coming into its own. Filling stations were beginning to

dot the landscape and the cities and the oil industry knew that kerosene had been dethroned.

By the time the war was over the swain who could not take his girl out for a motor ride was hopelessly outclassed. And so we rode into the "New Era" with all its dire consequences, the greatest "joy-ride" in history.

But the economic effects of the motor car and truck were as far reaching as the social. The mobility of manpower gained by putting the American people on wheels has infinitely increased our industrial and commercial efficiency. The movement of goods has been enormously accelerated and the scope of service tremendously expanded by the motor truck.

Started People Moving

Trade has been intensified and spread as the nation has been drawn closer together and at the same time more widely scattered by this ease in transportation. Where a visit to Chicago, California or Florida was once a life time remembrance it is now within the command of any owner of a car. The farmer is no longer isolated nor the city dweller confined within the narrow purlieus of his own neighborhood.

Nothing in history ever started so many people moving as the discovery of oil.

Individual transportation, however, boon though it be, may prove no greater than others yet to come. The Diesel motor ship and the Diesel electric train are but the beginning. We have hardly tapped the possibilities of petroleum for power. The farm tractor and the gasoline motor are but the precursors of power plants that loom in the future, powered by oil.

The really marvelous thing about oil is our inefficient use of it. Even in our finest motor cars it is admitted that we use but a fraction of the potential energy contained in the gasoline. Only the other day Henry Ford told an interviewer that "automobiles today are in the oxcart and corduroy road stage of development. It almost frightens me when I look ahead and see how far we've got to go."

If that is so of the development of the gasoline motor what can we expect from the further development of the other utilizations of oil for power, for heating, for chemical and medicinal and all the other purposes into which the many products of oil enter.

Look at the development of natural gasoline—the utilization of bottled gas bringing fuel to the most isolated places. Consider the expansion of natural gas distribution, a thousand miles from the wells. Take the discovery of helium. What benefits may lie hidden in the composition of petroleum awaiting the magic touch of science to bring them forth!

Without Oil?

Without oil we might never have known that man can fly. Both the dirigible and the plane depend upon oil for power. Without that "ocean of oil" on which Curzon said the Allies floated to victory who can guess how or when the war would have ended. Where would we have found lubricants for the vast industrial machinery of the modern world?

Where would the two millions employed in the oil industry have found employment and the other millions whose employment depends upon the oil industry in the manufacture of automotive vehicles, in the manufacture of the steel, glass, tires and other parts of the car and truck and bus, in the building of highways and the countless other enterprises that owe their existence primarily to our having found oil?

Not only does the oil industry supply motive power for the car and truck but it furnishes the carbon black that is essential in tire making, the asphalt and road oil used in the construction and maintenance of the streets and highways upon which the cars and trucks run, and it also, through the taxes paid on gasoline, pays for these highways which would otherwise be unneeded and unbuilt without it.

The revenue obtained from oil is the chief item in the upkeep of great States and the diversion of the tax on gasoline adds many millions to the revenues of others. Including the taxes levied on motor vehicles which of course would be non-existent without the oil industry the discovery of oil made possible the turning into the public treasuries of more than a billion dollars a year.

Hazards Encountered

Since the Drake well over thirteen billion dollars have been invested in the oil industry. Less than 60 per cent has ever been recovered through the sale of crude oil. That is the hazard of the business. Yet the public, hearing only of spectacular successes, takes no account of the obscure losers who have so often sunk their all in a hole in the ground.

The story of the oil industry, more than that of any other, has been checkered by triumphs and tragedies. Andrew Carnegie once said that the steel industry was "either a prince or a pauper." But it can show no such vicissitudes as the oil industry. Its raw material ranged from $20 a barrel after the discovery to 10 cents a barrel within a couple of years. Excepting during the war when the Allies were drawing upon America for oil there never has been a shortage. Usually there has been overproduction, as at present.

But the magnitude of the industry and the demand upon it have required almost constant search for future reserves. It has been calculated that the drilling of some 20,000 wells a year is required to assure a supply over a period of years ahead, the normal reserves demanded by ordinary business prudence in view of the investment.

More than 2,250,000 investors have a stake in the petroleum industry. An annual expenditure of more than $500,000,000 is required to drill the 20,000 wells needed to maintain the reserves. Compared to the average annual investment in the steel industry, for example, this is five times as large.

STUPENDOUS STATISTICS OF THE OIL INDUSTRY

Investment in the oil industry since 1859	**$13,000,000,000**
Annual expenditures to maintain reserves	**$ 500,000,000**
Number of stockholders	**2,250,000**
Number of employes	**2,000,000**
Taxes paid on gasoline in 1933	**$ 700,000,000**
Total taxes paid by industry 1921-1932	**$ 4,862,291,829**
Total net earnings 1921-1932	**$ 1,994,039,974**

Exceptional Hazard

Yet, notwithstanding the exceptional hazard in the finding of its raw material and the heavy investment required to maintain the supply, the oil industry has consistently sold its products to the consumer at a lower level than all other commodities, a fact attested over a long period of years by governmental statistics. It has sold its chief product so cheaply that the Federal and State governments have been able to levy a tax as large as the return to the producer of the crude and the manufacture of the gasoline together.

All, this, moreover, based upon the depletion of an irreplaceable raw material, a fact that ordinarily would call for higher return on the greater risk. This is not the least of the peculiarities of the oil industry. It may be the fatalism in the blood of every wildcatter which lures him to "shake dice with Destiny."

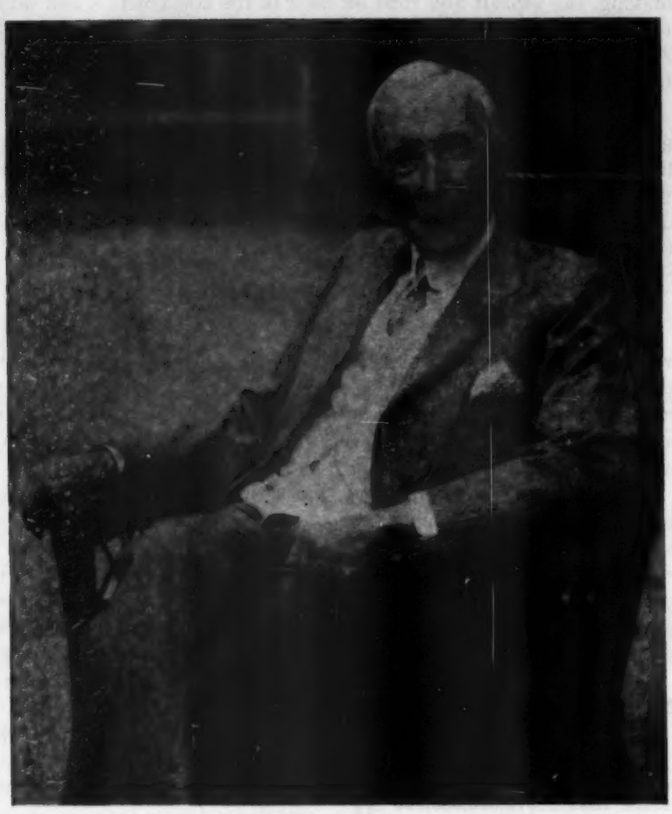
Brighter Outlook

Possibly it was a recognition of the pass to which the industry was being brought by this idiosyncracy that led the government to single it out in the recovery program for a treatment all its own. After 75 years it seemed as much in need of a guardian as in the days of Pithole, since it was allowing the same errors to produce the same disastrous effects.

Happily, as the Diamond Jubilee anniversary approaches, there are encouraging signs of a new sanity in the oil business. The event may be a double celebration, commemorating the birth of the industry and ratifying its stabilization as a business and not a game.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

ROCKEFELLER NAME SYNONYM FOR OIL AROUND THE GLOBE



John D. Rockefeller

As well stage "Hamlet" without Hamlet as present the dramatic rise of the oil industry without its leading figure. Mention oil in any part of the globe and one name immediately flashes into association with it, the name of the American who symbolized in the world's eyes the sudden wealth universally supposed to be found in America.

"As rich as Rockefeller" became a byword conjuring a vision of oil gushing from the earth very much as water gushed from the rock when Moses smote it.

How far does popular fancy and legend stray from the truth! There is no record of Mr. Rockefeller having drilled a single well or having produced a barrel of oil in the years when his name first came to symbolize oil.

His first visit to the oil regions in the spring of 1860, just when the great oil rush was getting into full swing at Titusville, was remarkable in that he was one man, in the midst of the frenzied excitement of the time, who was not carried off his feet.

No Gambler with Fortune

He had not come to gamble with Fortune. What he had he had worked for and saved and all his business experience was against the hopes of those who were waiting for wealth to be poured into their laps by a turn of Luck.

A man whose passion for bookkeeping exemplified the meticulous orderliness of his mind recoiled instinctively from the chaotic tumult of that first oil field. Then there was the uncertainty, even if you "struck oil" of what it would be worth. It was $20 a barrel at Drake's well and until January, 1860. In February it was $18; in April $12; and, as more wells were drilled, it dropped to $7 and by December was down to $2 a barrel.

The young merchant from Cleveland, habitually accustomed to analyzing a situation before he acted, viewed oil not as a "game" but as a business.

Coal oil made from shale cost $1 a gallon. Crude oil ranged from $2 to $12 a barrel and the cost of refining was about 30 cents. Oil was bound to displace coal oil if the supply were assured. What he had seen at Titusville convinced the 21-year-old visitor that drilling for and producing oil was subject to entirely too much hazard and competition for a cautious business man. But if the supply held up there were possibilities in refining oil and marketing it in competition with coal oil. For the time being, however, everything was too uncertain for decision.

To fully appreciate this initial judgment of Mr. Rockefeller after his first contact with the oil industry it is necessary to examine his background, his youth and upbringing.

A biographer describes him when 4 years old as a strong, quiet, grave-faced child, with a habit of looking intently at people and things and a fondness for playing by himself.

First Earnings

At 7 years of age he is reputed to have earned 2 shillings by picking up stones on a neighbor's farm and those 2 shillings, were, according to tradition, placed in a little blue bowl on a chest in the living room and scrupulously added to as opportunity offered.

His first business venture came when he was eight years old, when his home was on a farm near Moravia, Cayuga County, New York. A turkey hen had wandered away and hidden her nest. The boy's mother said he could have the little turkeys if he found the eggs. He found them after two days of persistent search, helped raise the turkeys and sold them.

Later when he was 10 he dug potatoes for a neighbor and finally had accumulated $50 which he lent to a farmer at 7 per cent. A year later the farmer handed John the $50 and $3.50 interest. It is related that the thoughtful lad who had been hoeing potatoes for 37½ cents a day was deeply impressed with the thought that the money his savings had earned was equal to almost 10 days of hoeing. "From that time on," he was reported saying in later years, "I was determined to make money work for me."

"I had a peculiar training in my home," said Mr. Rockefeller in relating some of his earlier experiences. "It seemed to be a business training from the very beginning. I was taught to be self-reliant. I was taught as much business at the age of 10 and 11 as it was possible for me to do. I was sent over the hills to buy cordwood. I did not require the presence of anybody to enable me to secure good measure from the man who sold the wood. It was good training for me."

When the family moved to Ohio, John was 14 years old. He finished his education with a term at a commercial school in Cleveland. A characteristic story is told of this period. He liked to play checkers. One of his opponents chafed at his deliberation, ejaculating: "Hurry up and move. What do you take so long for?"

John looked up gravely.

"I'll move as soon as I know what move to make."

He studied a moment longer, then asked:

"What do you think I am playing for—to let you beat me?"

This habit of figuring out stuck to him when he made his first visit to the oil fields. There was no impulsive jumping to conclusions which perhaps were not there.

When the time came for him to seek a job he had a plan. He passed all retail stores and small shops, going only to banks, railroad offices and wholesale merchandising offices. He called only on the head men. Weeks in a sweltering summer were fruitless. In September, 1855, he went to the office of Hewitt and Tuttle, produce commission merchants, and told Mr. Hewitt he understood bookkeeping. The junior partner, Mr. Tuttle, kept the books but needed help. Ever after, September 26 has been celebrated in the family—the day John D. Rockefeller got his first job.

The new clerk gradually took over the books and assumed one job after another, making good bargains and scrutinizing all bills. Once, while in a neighboring office, he saw a merchant glance hastily at a newly presented bill and order the clerk to pay it.

Young John was astonished and inquired:

"Do you pay your bills without going over every item?"

The old merchant laughed.

"In our office I look at every single item," said John, "and it must be right before our bills are paid."

Office of Rockefeller & Andrews in Cleveland, Ohio, in the sixties

That was the type of training he had had, the ideal of business thrift and scrupulous attention to details that was held up before the rising generation of that day but seldom so completely and conscientiously followed as by this grave young bookkeeper. America was still young enough to appreciate "Poor Richard's Sayings" and the homely virtues embodied in Benjamin Franklin's philosophy.

It was about this time that young John bought a little book for 10 cents and wrote across it "Ledger A," opening a bookkeeping account of his own. The first entry is a gift of 10 cents to the "Missionary Cause." His mother came from a devout Baptist family and John early associated himself with the church and Sunday school in Cleveland. Other entries in "Ledger A," in December were "10 cents to Mr. Downe, our young minister; pew rent $1; Sabbath school, 5 cents; present for Mr. Farrar (superintendent) 25 cents; Five Points Mission, N. Y., 12 cents; Macedonian (religious

paper), 10 cents; present to teacher, Deacon Sked, 25 cents." In five weeks the donations amounted to $1.82, or about one-tenth of his earnings, although the boy had not yet received any pay, in fact it was not until he had worked 14 weeks that Mr. Hewitt paid him $50, or about $3.50 a week.

His salary during 1856 was $400 and very little more the following year. Mr. Tuttle had left the firm and John, now 18, was doing more work, and he told Mr. Hewitt he was worth more than he was getting. Mr. Hewitt offered him $700 but John thought he ought to have $800. Mr. Hewitt promised to think about the matter but while he put off a decision, M. B. Clark, a young clerk in another commission house, who had saved $2,000, came to John and proposed they go into business for themselves.

First Business Venture

John had only $800 but scraped together another $200 and borrowed $1,000 from his father, and on April 1, 1858, the firm of Clark & Rockefeller opened its doors. It prospered. John looked after the finances, and traveled soliciting business. He quickly learned that business conducted on a large scale can be operated more cheaply and began buying in carload lots, getting better prices and lower railroad rates.

Two years later "Mr. Rockefeller," as he had now become because of his reputation for reliability, business ability, and success, although but 21 years of age, was chosen by several Cleveland business men interested in reports of the "oil strike" to go to Titusville and find out what was going on.

Meanwhile little refineries were being started in Cleveland, one 10-bbl. affair by a young candlemaker, Samuel Andrews, who was quick to see that kerosene would displace coal oil. He found means of getting a higher yield of kerosene than his neighbors and was among the first to use the residuum as fuel for his still.

He was an occasional visitor to the Clark & Rockefeller store, and kept asking them to back him in a larger refinery. Crude in 1862 was so plentiful it was selling for 10 cents a barrel. Finally, Mr. Rockefeller and his partner, Mr. Clark, invested several thousand dollars in a new firm to be called Clark & Andrews.

The new firm did so well that by January, 1865, when Pithole came in Mr. Rockefeller decided to sell his interest in the produce business and concentrate on oil, buying out Mr. Clark and forming the partnership of Rockefeller & Andrews. The refinery had a capacity of 150 bbls. a day.

It has been said that as he looked over the oil industry of that day he saw nothing but disorder, chaos, waste and incompetence, competition at its worst. This destructive competition was being intensified by a flood of crude and by the widening of markets for the new product.

Refiners in Cleveland bought their oil from jobbers. Rockefeller & Andrews made arrangements to purchase oil directly from the wells. "Attention to little details," improved processes increasing yield, making their own barrels, doing their own hauling, enabled them to turn out kerosene at lower cost, and to branch out into the western and southern trade.

William Rockefeller was sent to New York to conduct the firm of William Rockefeller & Co., which became the selling and exporting agent for the Cleveland refinery. It must be remembered that at that period Europe was the world's largest market by reason of population and wealth. Mr. Rockefeller was prompt to recognize this. He was then but 28 years old. His name was to become a synonym for oil the world over.

The growth of the firm had been so rapid that its expansion continually required more capital. Through H. M. Flagler this was provided by S. V. Harkness and the name changed to Rockefeller, Flagler & Andrews, in 1867. A second refinery was built, operated by William Rockefeller & Co. By 1870 the business had grown so large it was decided to incorporate as the Standard Oil Co. of Ohio, with a capital of $1,000,000, a large sum in those days.

Cleveland had become the largest refining center and the Rockefeller refineries the largest in the world, 1,500 bbls. daily. He had his own warehouse in New York; owned his own tank cars and was among the first to employ chemical and mechanical experts to improve manufacturing processes and develop by-products.

A David Harem Era

The story of the rivalry of the various refining centers and of the railroads for their business is a story in itself. It was the age of rugged individualism at its ruggedest. It was a David Harem era where ability to outsmart the other fellow was the symbol of success. Scheming required secrecy and diplomacy in its palmiest days was no more close-mouthed than business in the sixties and seventies.

Competition was running riot and stopped at nothing. Advantage went to him who could take it. It was all in line with the philosophy of the times, may the best man win. But the resulting waste was enormous.

Competitive Waste

No one saw this competitive waste more clearly than Mr. Rockefeller. He had seen the savings effected by tireless economies in the manufacture of kerosene squandered in inefficient distribution. He resolved to have his own system of distribution. The cry of monopoly was revived and the Standard Oil Trust became the target of popular execration. On July 2, 1890, the Sherman antitrust act became law. In March, 1892, the Supreme Court of Ohio decided the Standard Oil Trust agreement was void. Subsequently the Standard Oil Co. of New Jersey was incorporated under the laws of that State as a holding company, but in 1911 the Supreme Court of the United States ordered dissolution into the 33 subsidiary companies.

Mr. Rockefeller had retired from active business life at 57, in 1896, but remained as president of the company until the dissolution.

Since the industrial revolution following the introduction of steam there have been two great economic epochs in the progress of civilization—the era of organization begun by John D. Rockefeller and the era of mass production initiated by Henry Ford. As a great institution may be but the lengthened shadow of a single man—the founder—American industry and commerce as we know them have been but the prolongation of the paths opened by these men, alike in their intensive individualism and the shaping which their lives have given to the lives of their fellowmen.

No one can read the life of Mr. Rockefeller without being impressed by the thought that this man simply applied to his business operations the principles which he had found successful in his personal life—thrift, economy, organization. He was the great organizer of all time. He could see beyond the narrow rim of today's opportunity to the vaster opportunity of the future. Where others could think only of the immediate results of their own operations he could envisage the effect upon the operations of the whole and guide his course accordingly.

Undaunted by difficulties, he conquered circumstances. He was akin to the pioneers who penetrated the wilderness to build America. Nothing better illustrates this characteristic than his use of the kerosene lamp to develop a world wide market for his then principal product. Standard oil can could be found in every quarter of the globe long before any other American product was more than a curiosity abroad.

It was this genius for organization that made him the magnet for competitors before Standard Oil was born. Outstanding success invites either admiration or envy. It is significant that when Mr. Rockefeller retired from active leadership he left control in the hands of men who had once fought him.

Conditions in those early days were realistically portrayed by the late E. T. Bedford in an article in Colliers some years ago.

A Partner's View

"The oil business was full of perils. It was almost a pure gamble. There were too many in it and many who were in it were just adventurers. The competition was ruthless — men cutting each other's throats at every turn. If John D. Rockefeller had never been heard of the conditions of that business would nevertheless have been impossible. I know. I was in it and was a competitor of the Standard Oil Co. Everyone in the industry was forever facing destruction."

John D. Rockefeller saw very clearly there was but one way to establish the oil business on a sound basis, "to eliminate the destructive competition, take the gamble out of it and that this could be done in but one way: By ending the savage competition and the abuses arising from it and by unifying the business under an efficient management."

This was incredible gospel to a generation that believed fiercely that "competition is the life of trade." John D. Rockefeller's thought of constructive organization, instead of destructive competition, was 50 years ahead of the time. He lived to see the Government lending its aid in eliminating wasteful competition and loosening the restrictions that had prevented more effective organization of industry and commerce.

People were fond of telling how Mr. Rockefeller wiped out his competitors but Mr. Bedford points out how far that was from the truth. "Practically all the great leaders of the Standard Oil Co. were Mr. Rockefeller's competitors.

"In one of his first attempts to bring the oil people together it was Henry H. Rogers who led the fight against him in New York and John D. Archbold who headed his opponents in the oil fields. Yet John D. Archbold later became a president of the Standard and still another was A. C. Bedford, a member of an oil family whose introduction to oil was as a competitor of the Standard. The president today, Mr. Teagle, is another whose family went into the oil business as a competitor of Mr. Rockefeller. At one time the 14 members of the directorate had all, with the exception of Mr. Andrews, been competitors of the company.

"John D. Rockefeller was the first to see these things, and it is strange that he should have been thought a criminal for first seeing and then putting into practice a new business policy which would one day become the accepted method of doing business in this country—and, I should add, the system which made us rich beyond all the nations of the globe."

Mr. Bedford's narrative of how he himself was drawn into the Standard and how he became connected with Mr. Rockefeller illustrates the situation:

"I was a member of the firm of Thompson & Bedford and we were struggling along against a profitless lubricating business. In the meantime Pratt & Co. had gone into the Standard and Henry H. Rogers had become one of its most important figures. Mr. Rogers came to me and suggested that the Standard would buy a half interest in our business and that we could then act as selling agents for the Standard in the lubricat-

Standard Oil group at Al Nickle's camp, Smithfield, W. Va., July 5, 1898. Front row, left to right: Al Nickle, Billy Edwards, Noah Clark, Daniel O'Day, Henry H. Rogers, Joseph Seep, John D. Archbold, and W. J. Young. Back row: John Worthington, C. N. Payne, William Fleming, H. L. Scrafford, W. J. Alexander, and G. T. Braden

Airplane view of Sun Oil Company refinery at Marcus Hook, Pa. Other refineries are located at Toledo, O., and Yale, Okla.

48 Years *Young!*

TIME and experience mellow our judgment, while youth provides the spark to keep us going constantly forward.

It's a happy combination when these are found together as they are in the Sun Oil Company . . . an organization begun shortly after completion of the now famous Drake Well.

From a small beginning in 1886, the organization has shown a steady and healthy growth. The first corporate organization to use the trade name "Sun" was the Sun Oil Line Company, incorporated in Ohio in 1889 with an authorized capital stock of $300,000.

In 1901 the Sun Company was incorporated in New Jersey with capital stock of $1,000,000 and in 1910 properties and assets of the various affiliates were combined.

Today, the business of the Sun Oil Company embraces every major phase of the industry. Its capital and surplus total about $80,000,000.

Through the ownership of producing and undeveloped oil leases, pipe lines, tank ships, tank cars, storage tanks, refineries, trucks, pumping stations and retail distributing stations, and all such other means as are necessary for a comprehensive operation of the business, the Company is virtually independent of outside facilities.

Not only is the Company a large producer and distributor of petroleum products in the United States and Canada but it is also one of the largest exporters of lubricating oils to Europe and other parts of the world.

The most widely known products of Sun Oil Company are BLUE SUNOCO MOTOR FUEL—the choice of over a million motorists because of its high-test, knockless action at regular gas price. SUNOCO "MERCURY MADE" MOTOR OIL—the only motor oil made by the "Mercury Process". *In addition* the Company also manufactures a complete line of lubricating oils, greases and several outstanding specialties.

SUN OIL COMPANY

PHILADELPHIA, PENNSYLVANIA

BRANCHES AND WAREHOUSES IN OVER 100 PRINCIPAL CITIES

ing business in the East. We agreed. Now see how things were done in those days. Today the matter would be managed very simply. The Standard would just buy 50 per cent of our stock. But we were not incorporated then. Few business houses were. So. Mr. Rogers, representing his associates, became one of our partners. Next we found that this interest of the Standard did not interfere with competition from them. Those were the days when competition was glorified—it was almost a religion. And so we went merrily competing with the branch office of the Standard in New York almost as busily as if nothing had happened. This, of course, could not last, and finally we were reincorporated, the Standard taking two-thirds of our stock and we being taking into the company to manage exclusively its lubricating business."

Matter of Profits

Another illustration is given by Mr. Bedford: "One time Mr. Waring, Silas Paine and I were very much concerned about a company in which we had about 75 per cent of the stock. Notwithstanding this, it continued to give us very aggressive competition. We thought our company should acquire the other 25 per cent and own it straight. We went upstairs to Mr. Rockefeller with our proposal. As we talked he listened intently and jotted down a few figures. He said very little. But when we were through he replied:

"'You know, I started life as a bookkeeper, and I have great respect for figures. Now, the figures I have put down here show this company under its present management is making such a good profit that we get more profit for our stockholders out of our 75 per cent interest than we get out of the same investment in our own company.'"

One time he wanted to introduce an improvement which would cost about $3,000,000. All his directors favored it but one, who thought it unnecessary, a futile expenditure, and might actually prove a loss. It was brought up meeting after meeting. Mr. Rockefeller might have gone ahead but he preferred to have this man's consent. Finally one day he said:

Offered to Take Risk

"Now you think this improvement is unnecessary and may prove a loss. All right. I make the following proposal: I will build this improvement out of my own funds and underwrite it for two years. At the end of that time if it is a success the company can reimburse me. If it is a failure we will just forget all about it and I will take the loss."

The objecting partner answered: "If you can take the risk, so can I." And the improvement was adopted.

A great pipe line enterprise appealed to Mr. Rockefeller's imagination and judgment and he wanted to go ahead with it. It involved an expenditure of nearly $50,000,000. One by one the partners were won over but a few held out against it. Mr. Rockefeller waited two years until he could see a unanimous agreement in the board.

Mr. Rockefeller was the organizing mind. Charles Pratt was the great merchant. Henry H. Rogers was the manufacturer; John D. Archbold, the producer, and William Rockefeller, the financier. Henry M. Flagler was the legal mind.

Mr. Rockefeller laid the foundations of his fortune when he was a very young man. Almost all of his associates were young men and they had reared the greatest business in America before they were 40 years old.

EARLY OIL EXCHANGES PROVIDED EASY WAY TO WIN OR GO BROKE

AMONG the various ways of winning or losing money which the oil business has offered from the beginning none probably exceeded the old oil exchanges in point of the swiftness with which they operated or the dramatic scenes which marked their active history, covering roughly the 21 years from 1874 to 1895.

Oil speculation was a mad game, which brought riches or ruin. Those who by some lucky venture found themselves in possession of sudden wealth often went back for more, usually to see the easily won fortune swept away in a few hours. Oil workers, bank cashiers, lawyers, machinists, doctors, farmers—all kinds of folk—yielded to the craze, frequently with disastrous results.

Trading before the oil exchanges were established was confined largely to persons who wanted the oil itself for shipment and refining. Accumulated stocks were light and price changes were wide and sudden. The first product of the Drake well sold for $20 a barrel of 42 gallons. The next year it sold down to $2.75. The extremes in 1861 were $1.75 early in the year and 10 cents in the autumn, when the output of flowing wells was running to waste. In March, 1862, prices ranged between 20 and 25 cents a barrel, but the next year, owing to declining production, increasing consumption and improved facilities for handling the oil, the price advanced to $4.

A commodity attended by so many changes in price and in such general demand excited the gambling instinct. Oil City, Pa., was the natural shipping point for the production of the Oil Creek Valley and here most of the oil buyers and shippers gathered.

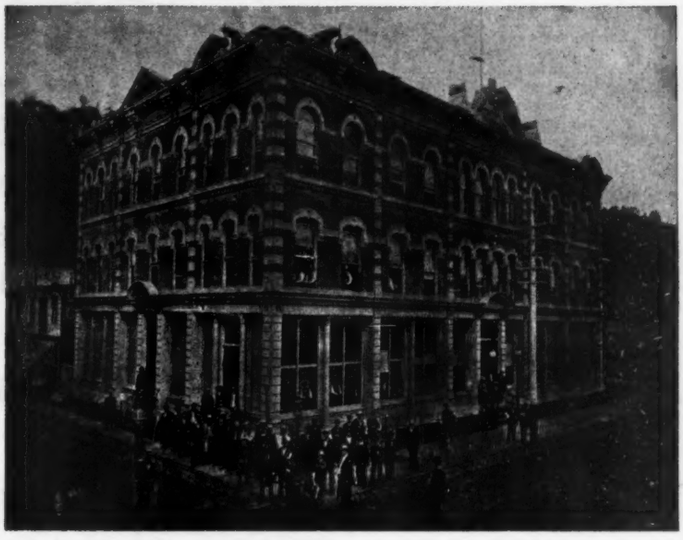
The first oil brokers generally visited the wells on horseback, buying what oil they could and making the best bargains possible with the producers. Refineries in Pittsburgh and Erie, Pa.; Cleveland, Ohio; Baltimore, Md., and New York had their agents along Oil Creek. These agents had offices in Oil City, and the Allegheny River bank near the town was lined with warehouses and wharves where oil was stored in barrels and in tanks and where fleets of oil-laden barges were made up to be towed down the stream by steamboats.

Oil Exchange on Wheels

The Farmers' Railroad between Titusville and Oil City was completed in 1866. A station was built on almost every farm along the line and as a result of the numerous stops the 17-mile trip consumed about three hours. Most of the patrons of the road were oil men. A special coach was put on for their accommodation and it soon became a veritable oil exchange on wheels. Deals were closed in it every day, large quantities of oil changing hands. This old passenger coach might well be designated as the first oil exchange.

There were no regulations for the transaction of business. There were no written agreements at first, no witnesses, nothing but private memoranda. A man's word was his contract.

The purchasers for refiners, acting as brokers, received a commission of 10 cents a barrel from buyers and 5 cents from sellers. "Spot oil" was to be moved and paid for immediately. "Regular oil" allowed the buyer 10 days in which to put the oil on cars. "Future oil" was taken as agreed upon by the buyer and the seller.



Oil City Oil Exchange building where men won and lost fortunes trying to outguess each other on the rise and fall of crude prices

The hazards of primitive transportation methods and rapid changes in supply and demand contributed to the swift and violent fluctuations in the price of crude. Production was in the hands of hundreds of independent operators. Marketing was in the hands of dozens of independent refiners. The buying and selling of oil for future delivery became a vocation in which fortunes were won or lost with ease. A 30-day option could witness a wide change in the price of oil, with the result that a trade involving a few thousand barrels might raise a man from want to luxury, or the reverse, depending upon which end of the bargain he happened to be holding.

Introduction of pipe lines removed one of the major uncertainties of transportation. After a while the pipe line companies introduced a plan by which any loss on oil in storage was covered by an assessment on all owners of the stored oil. Another step in the evolution of pipe line practice was the issuance of a certificate for each 1,000 bbls. of oil put into storage. The producer of the oil could accept a certificate instead of cash and could sell this certificate on the oil exchange or to the purchasing company.

Colonel Joseph D. Potts, early pipe line operator, was engaged in the early sixties to unify the freight services of the Pennsylvania Railroad and this led him to the pipe lines as the natural auxiliaries of the railroads. He induced the Pennsylvania to buy the pipe line which had been constructed between Pithole and the Miller farm on Oil Creek, in Pennsylvania. Colonel Potts was the first to issue pipe line certificates for credit balances of oil.

Oil was held free of charge in pipe line tanks for 30 days, after which a monthly storage fee of 25/1,000 of a cent a barrel was imposed. This was equivalent to 25 cents a month on a 1,000-bbl. certificate.

It came about that storage certificates issued by the United Pipe Line Co. offered a convenient medium for speculation. Delivery of the actual oil on exchange contracts was replaced by delivery of the certificates instead.

Forerunner of Oil Exchanges

The "Curbstone Exchange" in Oil City, often referred to as the forerunner of all the oil exchanges, sprang into existence in 1870. Producers, dealers and others would congregate on the sidewalk, discuss the day's news, swap stories and buy or sell oil. Most of this curbstone business was done in front of Lockhart, Frew & Co.'s office in Center Street. Charles Lockhart and William Frew were pioneer refiners in Pittsburgh, Pa., and heavy buyers of crude in Oil City.

Some of the Oil City brokers effected their first formal organization in December, 1869, and established headquarters in Center Street, Oil City. They moved to the Sands block in 1871, but in January, 1872, they were burned out. After that they used a room in the Opera House block and then a cheap structure which they built next to the offices of the Empire Transportation Co. The organization was dissolved in 1873 and for about a year the business of buying and selling oil was conducted at street corners, in hotel lobbies and in various private offices.

In February, 1874, a new organization was effected with George V. Forman, a leading oil producer, as president, and it was incorporated. During the first four years quarters in the Collins House were used. In the meantime plans were pushed for a new and, for that day, commodious building.

In 1878 the Oil Exchange Building

Why ETHYL GASOLINE

ETHYL'S SUPERIORITY OVER REGULAR GASOLINE IS GREATER THAN REGULAR GASOLINE'S SUPERIORITY OVER AVERAGE 3RD GRADE GASOLINE—MEASURED EITHER IN TERMS OF ANTI-KNOCK UNITS OR MAXIMUM PERMISSIBLE COMPRESSION RATIO

WHEN the octane scale was set up as a yardstick for measuring the anti-knock quality of gasoline, it was established solely for that purpose. It was never intended and never should be used as a measuring scale for engine design—except when properly interpreted through engine tests.

Relation of permissible compression ratio and octane number for any given engine is NOT a straight line function.

Figure 1. shows the relation of fuel anti-knock unit content to fuel octane number.

The average anti-knock quality of third grade gasoline today is about 59 octane number, although it may be as low as 45 octane number. Leaded regular-priced gasolines average 69 octane number. Non-leaded regular-priced gasolines are usually one to four octane numbers lower. The minimum standard of quality for Ethyl Gasoline is 76 octane number. In figure 1. the octane numbers of the three fuels are marked at 76, 69, and 59, respectively. Of course, the average Ethyl Gasoline falls within close limits—the spread of regular gasolines is much larger—and the variation among third grade gasolines is extreme. As may be readily seen, the position of these three points on the curve is such that the spread between 69 and 76 octane number provides more anti-knock units than the spread between 59 and 69 octane number.

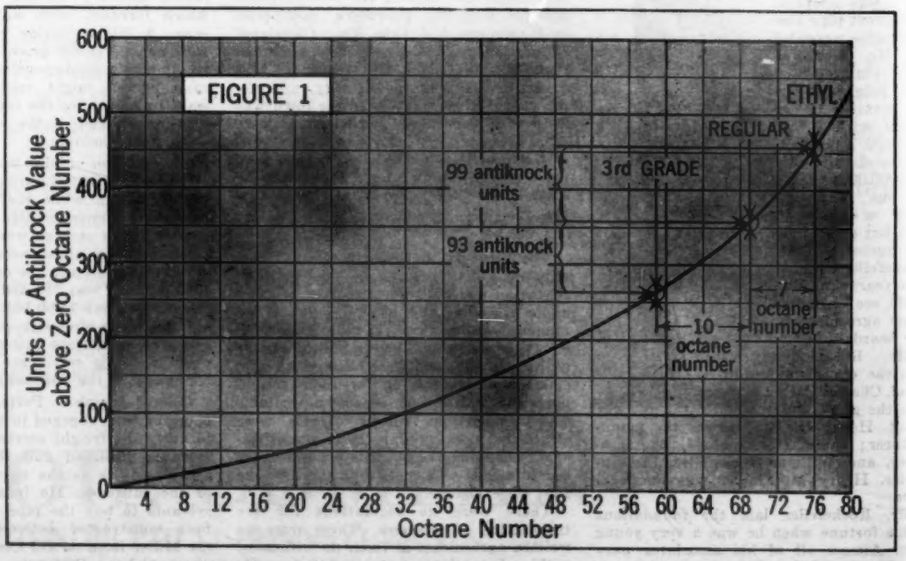
The price of regular gasoline in different sections of the country is on the average more than 2c over the price of third grade. The price of Ethyl is quite uniformly only 2c over the price of regular.

Figure 2. shows the relation of anti-knock units to compression ratio. The fact that this IS a straight line function demonstrates why the above statement is equally true when the value of Ethyl is measured in terms of permissible compression. Figures for compression ratio are not given on this chart because they vary with engine design, however, equal increments of anti-knock units permit substantially equal increments of increase in compression ratio regardless of engine type.

In brief: the above facts demonstrate that the difference in permissible compression ratio between Ethyl Gasoline and regular-priced gasoline is as great as the difference in permissible compression ratio between regular and third grade gasoline.

That's why Ethyl Gasoline is cheap at 2c a gallon more than regular.

That's why your 1935 engines should be designed to take full advantage of the anti-knock quality of Ethyl Gasoline.



Relation of Octane Number to Units of Anti-Knock — The increasing slope of the curve for this relation shows the greater value of one octane number as higher points in the octane scale are reached.

shown in the accompanying old picture was opened. The new quarters provided office rooms, committee rooms, reading rooms, telegraph lines and various conveniences for the 400 members then on the exchange roster. The building was between Elm and Center Streets in Seneca Street. The new organization adopted stringent rules, fixed the hours for trading in oil and put the business on a substantial footing.

A petroleum exchange of a sort was in operation in New York in 1866 at 52 and 54 Pearl Street. Here buyers of crude oil for refiners and exporters of the refined product, kerosene, congregated and transacted business. A regularly organized exchange was established in 1877.

Agitation for an oil exchange in Titusville began in 1865, but it was not till 1871 that an organization was completed. An oil exchange was opened in Franklin, Pa., in April, 1871, but its operations were dependent upon the market established in Oil City. Pittsburgh opened an exchange in 1878. Bradford opened one in 1878 and another, but short-lived one, in 1883. Exchanges were organized in Parker and Petrolia, Pa., and other towns.

The Oil City Oil Exchange early took the lead in the business of buying and selling oil, and its clearances were uniformly greater than in the other exchanges. It is a singular fact that an interior town, with a small population should have held a commanding position in the oil market long after it ceased to be the center of any important producing interests.

Up to the winter of 1882-3 the New York Petroleum Exchange was of minor significance in the oil trade. It then moved to larger quarters and trebled its membership to 600. About this time the National Petroleum Exchange was organized in New York with almost 500 members and the New York Mining Bureau, with a similar membership, began trading in oil. In April, 1883, these two institutions were consolidated, and in May, 1885, the old New York Petroleum Exchange was merged with the Consolidated board, forming the Consolidated Stock and Petroleum Exchange.

Gambling Peak Reached in Eighties

Betting on the vagaries of pipe line certificates reached its peak in 1882 to 1884. On a busy day 10,000,000 bbls. or more of oil, represented by slips of paper, would change hands about the "bullring" of the Oil City exchange and there was extensive trading in the other exchanges. This was many times more oil than there was above ground at the time. A gusher well could break the market. A wildcat dry hole or reports of salt water appearing in a pool could start a wave of buying.

The history of the early oil exchanges is spotted with days of panic and ruin. As fast as men who had staked and lost everything dropped out of the glittering game of chance to start life over again others were ready to take their places.

Among the memorably disastrous panics was that of May, 1884. Nervous alarm began with reports of business failures in New York and this quickly developed into wild fright on the oil exchanges. The market, which opened at 91¼ cents, closed at 83¼ cents after touching 81. Transactions on the Oil City exchange totaled 29,006,000 bbls. The excitement continued the next day, when more failures were reported. The oil market opened at 82 cents, went up to 85⅝, sank to 76¼ and closed at 77½. Transactions on the Oil City exchange reached 27,400,000 bbls. The Tuna Valley Bank in Bradford closed its doors. Many oil operators suspended work on account of the panic in the market. On the next day, May 16, the highest point touched by the market was 79 cents and the lowest 65½. Oil closed at 77⅞ cents. Sales on the Oil City exchange aggregated 4,960,000 bbls., indicating that the stampede was nearing exhaustion. The Exchange Bank of Bradford closed and there was a rush of small depositors to get money out of Warren, Pa., banks, but all of these remained open.

Dull trading marked the next day of business on the exchanges, and gradually the market resumed its normal character. In the meantime hundreds had "gone broke."

Galleries Packed With Spectators

The galleries of the exchange often were packed with spectators watching the excited brokers milling around the bullring. Many of them dabbled in the market themselves.

Just off the trading floor, and separated from it by a counter provided with paper and pencils, was the "sheep pen," where nonmember speculators went to be in close contact with their brokers. Messenger boys ran back and forth between the sheep pen and the bullring.

During the height of oil speculation brokers in various cities maintained private telegraph wires running to the floor of the oil exchanges where telegraph operators or messenger boys transmitted orders by cryptic signals to a member of the exchange who handled the outside broker's business and who kept in the operator's view at the bullring. Signals were changed frequently to lessen the danger of other persons understanding them.

To make clear how this operation was performed, take the case of Samuel Fertig, a broker in Titusville, who had a private wire running into the Oil City exchange. Sitting at the telegraph key a few yards from the bullring was Henry E. Browne, later to become superintendent of the Prairie Pipe Line Co.'s telegraph department and now assistant superintendent of the same department for the Sinclair Prairie Pipe Line Co. Young Browne would receive an order from Mr. Fertig's office in Titusville reading, "Buy five at best." He immediately would hold a hand upward with all five fingers extended. The upward position of the hand in the code he was using at that time indicated it was a buying order. The five extended fingers meant 5,000, for all transactions were in thousands of barrels and each extended finger stood for 1,000. The five fingers then were closed tightly into a fist. The fist meant "at the best price obtainable."

Like Signals to Baseball Pitcher

J. B. Faint, who represented Mr. Fertig at the bullring, understood these signals as perfectly as a baseball pitcher understands the signals given him by the catcher. Within a few minutes as a rule Mr. Faint would signal from the bullring that the order had been executed and the young telegraph operator would send a message back to Titusville to that effect.

Suppose the order from Titusville read, "Sell three at one-eighth." This time the telegraph operator's hand would point downward, showing that the order was to sell. Three extended fingers signified 3,000 bbls. Then a forefinger held horizontally indicated the one-eighth. It usually was unnecessary to signal more than the fraction, such as one-eighth, one-quarter, one-half, etc., it being understood that the other figures were those ruling in the market at the time. Thus, if oil was selling at slightly more than 80 cents a barrel, an order at one-eighth would mean 80⅛. In the code of signals two horizontal fingers signified one-quarter, three signified three-eighths, and so on.

The broker with a private wire had a distinct advantage over the others in that he was able to snatch quick profits from temporary differences between quotations in different cities when the market was lively and the regular telegraph lines were clogged with messages. Take as an example a broker in the Bradford exchange, with a private wire from the exchange in New York. Suppose a "flash" from New York said that the price in New York at that moment was 90⅜ cents a barrel, while in Bradford it happened to be 90. The broker would instantly bid 90¼ cents for 100,000 bbls., say, in Bradford (adding the eighth-cent to insure getting the oil). At the same time he would rush a selling order at 90⅜ to New York. If luck attended him—and usually it did—he would clean up $250 on the transaction. This performance was referred to as "scalping a quarter." Owing to the hazards involved the broker usually was satisfied with "scalping an eighth."

The broker received a commission of $1.25 for each 1,000 bbls. of oil he bought or sold for a client. It was not uncommon for him to make $100 to $300 in a day in commissions. It was inevitable that men who passed their days in such an atmosphere of excitement, unreality and fickle change should be a fun-loving, frolicsome lot, disinclined to view life seriously and always ready to take or perpetrate a joke. A favorite prank, especially on days when the market was slow, was that played on some stranger who appeared on the floor wearing a "plug hat," as the decorous silk headgear was called. The visitor commonly was a guest of some member of the exchange. He probably had been introduced to a few men here and there when suddenly his top hat was snatched from his head and an instant later he was outraged at seeing a whirling, howling mob of oil brokers kicking a silk hat around the room, jumping on it, tossing it from one to another, subjecting it to various indignities until it bore no resemblance to the thing of elegance it once had been.

The victim, speechless for a few moments, sometimes gave vent to his wrath in blistering maledictions when he recovered his voice. At this point one of the conspirators would appear in front of him and with a smile and gracious bow hand him his hat, undamaged and as shiny and magnificent as ever. Again he was inarticulate. Then as the truth dawned upon him he grinned and perhaps invited the crowd to go out and "have something on him." The battered headpiece which had been smashed with such abandon was one of a collection of out-of-date "plugs" kept for this special purpose and brought out as required.

Seep Agency Established

After the Standard Oil Co. was organized in 1871 Joseph Seep was made buyer of all the crude used by it until its dissolution by the courts in 1911. He operated under the trade name "The Seep Purchasing Agency."

Following the period of boiling speculation in the early eighties a decline in the business and the prestige of the various oil exchanges set in. What was virtually the end of the oil exchanges as going concerns came January 22, 1895, when the Joseph Seep Purchasing Agency, whose office was in Oil City, issued the following statement:

"The small amount of dealing in certificates on the exchange renders the transaction there no longer a reliable indication of the value of the product. This necessitates a change in my custom of buying credit balances. Hereafter in all such purchases the price paid will be as high as the markets of the world will justify, but will not necessarily be the price bid on the exchange for certificate oil. Daily quotations will be furnished you from this office."

End of the Exchanges

The oil exchanges, which had played so spectacular a part in a rapidly growing business, gradually disappeared from the stage. The Oil City exchange, which owned the building already referred to and shown in the illustration, sold it to the Oil City National Bank in 1909 and went out of business. The Bradford Oil Exchange, a close second to the Oil City institution in point of importance for a time, sold its building to the First National Bank & Trust Co. and the part which had been devoted to trading in oil was used for years as a public assembly hall and then became a moving picture theater.

When the Standard was dissolved Mr. Seep was made president of the South Penn Oil Co., which had been a Standard subsidiary and which continued to operate the purchasing agency. On April 1, 1931, the South Penn officially terminated the Seep Purchasing Agency, for half a century the largest buyer of crude in the eastern fields.

Parker Oil Exchange in 1874

Quick Wire Line Deliveries by The Continental Supply Co.

Mid-Continent Distributors for Broderick & Bascom, with well stocked stores in all active fields.

And Such Lines!

Yellow Strand!

Made of *tested, selected* wire to secure the fine balance of elasticity, flexibility and toughness so necessary for long life!

Made by a company with 58 years' experience making nothing but wire rope!

No wonder Yellow Strand lines have such an excellent reputation in the oil country.

NRA MEMBER U.S. WE DO OUR PART

Broderick & Bascom Rope Co.
Factories: St. Louis—Seattle.

R-8

Yellow Strand Rotary Drilling Lines

EASY NOW TO TRACE TRAIN OF EVENTS LEADING UP TO DRAKE'S GREAT ADVENTURE

"IN conclusion, gentlemen, it appears to me that there is much ground for encouragement in the belief that your company have in their possession a raw material from which, by simple and not expensive process, they may manufacture very valuable products."

So wrote Benjamin Silliman, Jr., professor of chemistry in Yale College, April 16, 1855, after an exhaustive analysis of petroleum sent to him by George H. Bissell and Jonathan G. Eveleth, New York lawyers, who had bought 105 acres of land on Watson Flats, near Titusville, Pa., containing an "oil spring." The report, though it clearly and authoritatively defined the economic value of petroleum and forecast its wide usefulness, singularly enough did not suggest such a thing as drilling for it. But the report entered the broadening current of events which were moving irresistibly toward the Drake well, starting point of a mammoth industry.

Chemists had been at work on the problem of supplying the world with a cheap, safe and efficient illuminant to take the place of beeswax and tallow candles, the greasy whale-oil lamp and the dangerously explosive camphine, which were the common sources of artificial light. In various parts of the world mineral oils closely allied to petroleum were being obtained by distillation of bituminous coal and shale.

Coal oil and shale oil were coming into increasing use with the wick lamp for lighting purposes when S. M. Kier, of Pittsburgh, Pa., pioneer figure in the history of petroleum, made some experiments which were to take an important place among developments eventuating in the first oil well.

Mr. Kier obtained his petroleum from a salt works at Tarentum, on the Allegheny River near Pittsburgh, Pa., where in 1847 he and his father, Thomas Kier, had leased land and put down two wells by the springpole method to a depth of about 400 feet. These wells were yielding oil in addition to salt water in 1849. No market for the oil presented itself till S. M. Kier hit on the idea of putting it up in half-pint bottles labeled, "Kier's Petroleum, or Rock Oil, Celebrated for Its Wonderful Curative Powers. A Natural Remedy. Procured from a Well in Allegheny County, Pennsylvania, 400 Feet Below the Earth's Surface. Put Up and Sold by Samuel M. Kier, 363 Liberty Street, Pittsburgh, Pa."

"Transcendent Power to Heal"

Other advertising explained that the "rock oil" is "pumped up with the salt water, flows into the cistern, floats on top, when a quantity accumulates, is drawn off into barrels, is bottled in its natural state without any preparation or admixture." Among other modest statements were: "Its transcendent power to heal will and must become known and appreciated when the voices of the cured speak out. When the cures themselves stand out in bold relief and when he who for years has suffered with the tortures and pangs of an immedicable legion that has been shortening his days and hastening him 'to the narrow house appointed for all the living,' when he speaks out in its praise who will doubt it? . . . It gets its ingredients from the beds of substances which it passes over in its secret channel."

A fairly profitable business was built up. Mr. Kier sent out agents to push the sale of his "natural remedy," but records indicate he was unable to dispose of all the petroleum he got from his salt wells, amounting to 2 or 3 barrels a day. In 1852 he withdrew his agents and disposed of such bottled oil as he could through drug stores. Sales fell off. Mr. Kier was acquainted with the efforts being made to find a new illuminant, and as he had observed the ready inflammability of his crude oil, which he frequently had burned at the salt wells, it occurred to him that he might produce the thing for which scientists were searching if only he could overcome the objectionable smoke and odor which characterized his petroleum.

Distillation might prove the solution of the problem. So Mr. Kier fitted a big cauldron with a kettle and a worm, and with this primitive still he ran off a distillate which at first was little better than the crude itself. But he persevered and about 1855 he is found selling a mediocre quality of kerosene through drug stores at $1.25 a gallon. In the meantime others were conducting experiments along similar lines.

Setting Stage for Drake Well

It can be seen in retrospect how the stage was being set for the adventure on Watson Flats.

The land which was to be the site of the world's first wildcat oil well takes its place in the story with the signing of the following agreement:

"Agreed this fourth day of July, A.D., 1853, with J. D. Angier, of Cherrytree Township, in the County of Venango, Pennsylvania, that he shall repair up and keep in order the old oil spring on land in said Cherrytree Township, or dig and make new springs, and the expenses to be deducted out of the proceeds of the oil, and the balance, if any, to be equally divided, the one half to J. D. Angier and the other half to Brewer, Watson & Company, for the full term of five years from this date, if profitable."

The signatures of Brewer, Watson & Company and J. D. Angier were affixed to this agreement.

Brewer, Watson & Company were engaged in lumbering operations on Oil Creek, in the Titusville district. The oil spring referred to was on the Willard farm, part of the land owned by the company. Ebenezer Brewer, of Pittsburgh, and Jonathan Watson, of Titusville, were the principal stockholders.

Under the agreement Mr. Angier dug a system of ditches centering in a common basin and frequently he encountered little pockets of oil in the gravel 3 or 4 feet beneath the surface. When the trenches first were opened 4 to 6 gallons of oil could be collected daily by an ingenious skimming device, but so much work was required to keep the oil flowing that the enterprise proved unprofitable and after a few months it was abandoned.

In the summer of 1854 Dr. F. B. Brewer, son of Ebenezer Brewer, visited relatives in Hanover, N. H., seat of Dartmouth College, from which he had graduated 10 years before. He took with him a bottle of the Watson Flats petroleum and gave it to Prof. Dixie Crosby, of the college. A few weeks later George H. Bissell, young New York lawyer, previously mentioned, and a graduate of the same school, was in Hanover visiting his mother and he called on his former instructor, Professor Crosby. The professor showed Mr. Bissell the sample of petroleum and commented enthusiastically upon its properties.

Incident Results in Land Deal

The upshot of this incident was that in November, 1854, Brewer, Watson & Company conveyed to Eveleth & Bissell a 105-acre tract of land containing the abandoned petroleum works on Oil Creek. The actual price paid was $5,000, though $25,000 was named in the deed, evidently for the better impression it would make in the formation of a stock company later.

Coal oil was being introduced into the eastern states as an illuminant at this period. Mr. Eveleth and Mr. Bissell, who knew nothing of the experimenting done by Mr. Kier, believed processed petroleum could be used in the same way if it could be produced in large enough quantities.

On December 30, 1854, the Pennsylvania Rock Oil Company was incorporated under the laws of New York "to raise, procure, manufacture and sell rock oil." Mr. Eveleth and Mr. Bissell, who were the prime movers in the company and who held a controlling interest, had no notion of the revolutionary changes in the world's way of living that would issue from this enterprise. They were not thinking of drilling a well. Their plan at this juncture was simply to expand the business of recovering surface petroleum by ditching and skimming. Mr. Angier was put in direct charge of this work.

A large sample of the petroleum was sent to Professor Silliman for analysis and a report. When the report was received in April, 1855, indicating the great commercial possibilities apparently open to this product printed copies were distributed among men of wealth. But the country was in the grip of a depression and results were scant.

Friction arose in the company, Mr. Angier's services were dispensed with and the development program came virtually to a standstill. But this meant only a temporary darkening of the stage on which one of the world's most interesting industrial dramas was unfolding.

In the summer of 1856 one of S. M. Kier's flamboyant medicine circulars fell under the notice of Mr. Bissell. The picture of the salt-well derricks and the statement concerning the depth from which Mr. Kier's petroleum was obtained are said to have prompted an idea in his own mind of the feasibility of sinking an artesian well on the Titusville property and of the value of such a scheme in getting moneyed men interested. He discussed the idea with his law partner, Mr. Eveleth, who received it enthusiastically. It was laid before other stockholders of the company, including James M. Townsend, New Haven, Conn., banker, then president of the Pennsylvania Rock Oil Company, who had induced Edwin L. Drake, railroad conductor, also of New Haven, to buy a few shares of stock.

Mr. Drake, soon to be known as "Colonel" Drake, was sent to Titusville to make a survey and report on the company's prospects. His favorable report resulted in his being engaged to go to the property in May, 1858, and superintend operations on it. The Seneca Oil Company, subsidiary of the Pennsylvania Rock Oil Company, had been organized as the operating company.

High Prices a Spur

By this time the demand for petroleum exceeded the supply. The price rose from $1 a gallon to $2. These prices indicated the favor which the new illuminant was meeting and spurred work on the Oil Creek property.

Colonel Drake's first year on the ground was devoted largely to futile efforts to dig a well, or big pit, down to the solid rock, in the meantime planning to drill as soon as he could make the necessary arrangements. On August 16, 1858, he wrote: "In sinking our last well we struck a large vein of oil, but the same thrust of the spade opened a vein of water that drove the men out of the well and I shall not try to dig by hand any more as I am satisfied that boring is the cheapest."

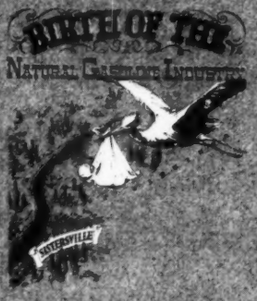
In the middle of June, 1859, the drill was started. The Drake well was on its way.

Failure had followed one attempt after another to hire a "borer." "Uncle Billy" Smith, a blacksmith, of Tarentum, eventually was engaged. Samuel Smith, a son of Uncle Billy, and now residing at the age of 90 in Titusville, says this arrangement was made on the recommendation of Lewis Peterson, well-to-do resident of Tarentum.

On Saturday, August 27, 1859, Uncle Billy's drill hit the pay.

The Drake well, seen now as the outgrowth of an economic necessity, was an accomplished fact. A new era had begun.

A QUARTER In The NATURAL



Since the very birth of the Natural Gasoline Industry in West Virginia, members of this organization have been manufacturing Natural Gasoline every day.

A QUARTER OF A CENTURY IN THE NATURAL GASOLINE INDUSTRY

Built in 1908 the first "Hanlon" gasoline plant near Sistersville, W. Va., had a daily capacity of but 6 "iron barrels" — today Hanlon-Buchanan, Inc., annually ships millions of gallons stabilized Natural Gasoline to domestic and world markets.

Against a hillside in "Polecat Hollow" on the outskirts of Sistersville, Ed Hanlon and other pioneers of Natural Gasoline under the direction of Colonel R. W. Dunn, Chief Inspector of the Bureau of Explosives conducted the first vapor pressure test of Natural Gasoline.

STA-VOL-ENE

IT'S A "NATURAL"

Hauling Natural Gasoline from the first "Hanlon" plant to the Ohio River at Sistersville and loading aboard the "Martha" for shipment to Parkersburg in 1909 — when 6 "iron barrels" was a big order.

Hanlon-Pioneer NATURAL GASOLINE

TULSA
NATIONAL BANK OF

Traffic jam in early 60s. The Allegheny River at mouth of Oil Creek

TRANSPORTATION PROBLEMS OF FIRST ERA MAKE TODAY'S DIFFICULTIES SEEM SIMPLE

TRANSPORTATION—ERA NUMBER 1

Transportation was the big immediate problem following the completion of the well drilled by Col. Edwin L. Drake on the banks of Oil Creek. Prior to this time, limited quantities of crude oil, obtained from salt wells and seepages, had been used chiefly for the medicinal qualities attributed to it. As early as 1806, men on horseback carried small kegs of this crude oil from the Oil Creek section of Pennsylvania down to Pittsburgh which, at that time, was the chief market for this medicinal product.

The patenting of a process for making illuminating oil in England in 1850 and in the United States in 1852 created a greater demand for crude oil. In 1858, the entire business in petroleum amounted to 1,183 bbls. of 40 gallons each. Of this amount, 1,008 bbls. came from two salt wells at Tarentum, Pa., and the remaining 175 bbls. came from Enniskillen, Canada. Petroleum was now bringing $1 a gallon, and the Carbon Oil Co., located in New York, finding considerable demand for it with a very limited supply, advanced the price to $1.25 and ultimately $2 a gallon. These prices were a prime factor in sending Colonel Drake on his mission of discovery.

The Drake well produced approximately 20 bbls. a day. Immediately after its completion, other wells were started in the Oil Creek section. Production of crude oil started to mount steadily and the total output in 1860 was estimated at 500,000 bbls. from wells drilled for the sole purpose of finding crude oil. These first crude oil producers were located in the wilderness about 30 miles from a railroad station. Colonel Drake's well was located on the bank of Oil Creek, approximately 11 miles from where Oil Creek entered into the Allegheny River. It was natural with the first developments extending along Oil Creek that this stream be used for transporting crude oil.

Where wells were located along the banks of Oil Creek, crude oil was loaded directly into barges and dugouts and floated down the Allegheny River by a system of "pond freshets." These "freshets" were developed by numerous dams constructed along all the creeks in the section by lumber mill owners for use in transporting lumber down the creeks and the Allegheny River to Pittsburgh.

Heyday of the Teamsters

Transportation of crude oil really became a nightmare when the various developments extended back several miles

One of 6,000 teams

from Oil Creek. There were little or no roads through the country. Cooperage plants sprung up throughout the territory and the crude oil was placed in barrels. The only means of transportation to Oil Creek was by team and wagon. Thousands of horses were needed to haul this oil to the shipping points. The result was a wagon train which at one time consisted of 6,000 two-horse teams and wagons. These teams and wagons churned up the ground in the quickly turned up roads into a sea of mud into which the horses often sank beyond their depth and were killed. At early dawn the stream of teams would start to move from the wells to the refineries and shipping points. Most of these points were from 8 to 20 miles distant; $2.50 to $3 per barrel and from that to $5 per barrel was paid for hauling the crude. For at least three hours each morning the procession of teams was uninterrupted. It was impossible for anyone to cross this line of traffic in the small towns which sprung up in the oil region and through which the teams and wagons with the crude oil passed. Teams would splash from one deep hole to another. A horse would go down and would be drowned in the seemingly bottomless mud. Traffic was halted momentarily while the animal was dragged to the banks of Oil Creek and another horse put in its place. The noses of the horses touched the rear barrel of the load preceding them. At night when the teamsters returned with their empties, the same scene was enacted. Teamsters would pull down fences and drive through fields whenever possible until the valley of Oil Creek became an almost bottomless quagmire.

Arriving at Oil Creek, the oil was emptied from the barrels into barges, many of which were 50 feet long and 15 to 20 feet in width, lined with tar and caulked with oakum. These were the better class boats. Others were roughly constructed rafts—in fact almost anything which would hold barrels or oil in bulk was utilized.

Pond Freshets and Traffic Jams

When the boats and rafts were loaded with crude oil, word was sent to the mill owners owning the dams and at a given time the dams were opened and the "pond freshet" started down Oil Creek. With these boats, barges and rafts strung along almost the entire length of Oil Creek, it is easy to visualize what happened when the rush of water came down the creek. Logging in the Northwest was tame compared to handling these unwieldly craft in the rush of water. Boats and rafts jammed together and splintered, barrels were broken, releasing the oil which rushed on down the creek with the "freshet." Occupants of the boats and barges had but one thought—to save themselves. Many lives were lost in these traffic jams. Months of work in constructing boats and the production of wells for weeks often was lost in a few minutes during one of these jams in the "pond freshet." During the period of this means of transportation, it is estimated that probably not less than 1,000,000 bbls. of oil was lost on the waters of Oil Creek and the Allegheny River. At one time 2,000 creek and river boats were engaged in this traffic. Each "freshet" cost from $200 to $400 which was paid to the mill owners for storing the water and using their dams. Barrels sold for $1.75 to $2. The output of the barrel works fell far short of supplying the demand. The cost of shipping oil by barge from points on Oil Creek to its mouth ranged from 2 to 5 cents per barrel, according to the stage of the water. In natural stages, prices were lower. Artificial floods, known as "pond freshets," demanded higher prices. At the outset the toll charge for water by the millers was reasonably small, being about 2 cents per barrel. This toll was collected by agents passing along the creek, collecting the amounts assessed, according to the capacity of the barge, before the dams were opened. "Freshets" were arranged once or twice a week during the dry seasons and shipments of not less than 10,000

Loading tank cars

bbls. were required to meet the cost of each "pond freshet." As the price increased, larger shipments were required; 20,000 to 30,000-bbl. shipments on "pond freshets" being of frequent occurrence.

Pipe Line Is Suggested

The high cost of transportation, combined with fluctuating prices for crude oil at the market necessitated the development of a more economical means of transportation. The first suggestion of a pipe line for transporting crude oil seems to have been made by Gen. S. D. Karns, at Parkersburg, W. Va., in November, 1860. Mr. Karns said that as soon as he could raise the money he would lay a 6-inch gas pipe line from Burning Springs to Parkersburg and let the oil gravitate to the Ohio River, a distance of 36 miles. The lack of finances or some other reason prevented the construction of this line.

In 1862 J. M. Barrows constructed a pipe line 1,000 feet long to convey oil from the Densmore wells on the Tarr farm to his refinery. This line has been referred to in early writings as the first pipe line "correct in principle and successful in operation" although these same writings later refer to the Van Syckel pipe line as the "first successful pipe line."

In the spring of 1862, J. L. Hutchinson came to Titusville with a rotary pump he had invented. He explained to John Dalzel, then a leading Oil Creek producer, the utility of this force pump but received no encouragement toward the establishment of a pipe line where his device could be used. However, he continued his efforts to obtain support and finally a company was formed under the name of Hutchinson & Foster, which, in the summer of 1863, broke ground for the construction of a pipe line 2 miles in length. This line, made of 2-inch cast iron pipe, poorly jointed at the ends, was laid from the Tarr farm to the Humboldt refinery located on upper Cherry Run, one-half mile below Plumer. The refinery was located on the far side of the hill, 400 feet high. One of the force pumps was located on the Tarr farm and two additional pumps were placed on the Tarr farm side of the hill. This pipe line was a theoretical success. It demonstrated conclusively that crude oil could be forced through pipes and over hills. However, the poorly constructed joints of the pipe line parted under the pressure of the pumps and leakage was so great the line really was a failure as far as the actual delivery of crude oil to the Humboldt refinery was concerned.

Transferring oil across railroad

In the summer of 1863, the Oil Creek railroad was extended 4 miles down the creek to the Miller farm. Three miles further down the creek were the Sherman Flats where some of the larger oil wells of the region were producing. The end of the railroad on the Miller farm was 50 feet higher than the wells on Sherman Flats. A company was organized under the name of the Western Transportation Co. and began construction of a 4-inch pipe line from Sherman Flats to the railroad at Miller farm. In the construction of this line, air chambers, 10 inches in diameter, were cast on the pipe to equalize, so it was claimed, the pressure of oil upon the pipe. These air chambers gave the line the appearance of an ornamental iron fence. The joints of pipe were calked with lead. The line was constructed during the fall and winter of 1863. When placed in operation, the pressure was so great from the pump, located on Sherman Flats, that large leaks developed at the joints and more than 10 per cent of the oil was wasted. Producers, when unable to collect for the oil lost through leakage, fell back to the old method of transporting by wagon. The pipe line was abandoned and lay along banks of Oil Creek for a period of two or three years.

First Successful Pipe Line

The first really successful "long distance" pipe line for the transportation of crude oil was that constructed in 1865 by Samuel Van Syckel. It was a 2-inch line, 5 miles in length, and extended from Pithole to the Miller farm. The pipe for the line was made to order at Reading and was of wrought iron. Trenches were dug and the line was laid 2 feet under ground "so as to be out of the way of the farmer's plow." There were two pump stations on the line, one located 1 mile west of Pithole and the other at Cherry Run. This line was started on September 5, 1865, and completed October 7 the same year. Before the whole length of this line was completed some of it was pried out of the ditch and teams hitched to it and the line broken. It is believed teamsters, seeing their means of livelihood taken away, were responsible for breaking the line. Mr. Van Syckel sent to New York and bought a number of rifles and selected a patrol of men, gave them the rifles and orders to shoot the first culprit caught tampering with the pipe line. This effectually stopped trespassing. The line was entirely successful from the start of its operation. There was little or no leakage and 800 bbls. of oil could be pumped through the line in the course of a day. The pipe line tariff on this line was $1 per barrel.

The pumps used on the Van Syckel pipe line were furnished by Reed and Cogswell, who had an interest in the line. They were of the two-flywheel type, having pins in the flywheel arms.

Shipping crude by barrels down oil creek

Against a pressure of 200 or 300 pounds, they would handle from 30 to 40 bbls. of oil an hour.

In the fall of 1865, Henry Harley started the construction of a 2-inch pipe line from Benninghoff Run to Shaffer, the terminus then of the Oil Creek & Allegheny River Railroad. While this line was in the process of construction, teamsters of Shaffer farm and vicinity, then forming a large part of the population, regarded the pipe line as legalized robbery and as an infringement upon their rights as common carriers. Mr. Harley's life was threatened, wooden tanks filled with oil on his properties were set on fire, and numerous efforts were made to destroy the pipe line by breaking it apart and tearing the joints. Mr. Harley sent to New York and hired a number of detectives. These men, posing as teamsters, worked with the teamsters against the line and finally secured enough evidence to convict 20 members of the mob who were arrested and jailed at Franklin. This action had a salutary effect upon the teamsters who, upon completion of the Harley line and its very successful operation, picked up stakes and moved from the territory. Mr. Harley's line was constructed of extra weight 2-inch pipe. It had a pump located at Benninghoff and delivered from 600 to 800 bbls. of crude oil per day to tanks located along the railroad at Shaffer. This pipe line displaced 400 teams and wagons.

The largest field in the world the East Texas Field, some 40 miles long from north to south, with over 14,000 wells, is larger than the combined area of six of the largest fields in the United States, including the Seminole and Oklahoma City fields in Oklahoma, the Kettleman Hills Field in California, the El Dorado Field in Arkansas and Yates and Hendricks Fields in Texas.

In December, 1866, Jonathan Watson, of the First National Bank of Titusville, came into possession of the Van Syckel pipe line and subsequently disposed of a portion of his interest to William H. Abbott. In June, 1866, Mr. Abbott formed a partnership with Henry Harley that consolidated the Van Syckel and Benninghoff Run pipe lines.

Abbott and Harley Lines

In 1867, Abbott and Harley combined with the Western Transportation Co., the only one in power to pipe oil to railroad stations under the charter granted by the legislature of the State of Pennsylvania. Abbott and Harley had purchased the controlling interest in the Western Transportation Co. and they organized all their lines under the charter of this company and took the name of the Allegheny Transportation Co. The first board of directors of this company, elected January 25, 1860, were as follows: Henry Harley, W. H. Abbott, Joshua Douglass, J. P. Harley, and Jay Gould, then president of the Erie Railway Co.

Early in 1871, the Oil Creek & Allegheny River Railroad, seeming to feel that the Allegheny Transportation Co. was organized in the interests of the Erie Railway Co., organized a company under the title of the Commonwealth Oil & Pipe Line Co. in the interests of the Oil Creek & Allegheny River Railroad. In August of the same year, Mr. Harley opened negotiations with the Oil Creek Railroad for the purpose of effecting a combination of interests and shortly afterward terms were agreed upon, resulting in the organization of the Pennsylvania Transportation Co. with a capital of nearly $2,000,000 and 500 miles of pipe line to Tidioute, Triumph, Irvineton, Oil City, Shamburg, Pleasantville, and Titusville, centering at the Miller

Railroad end of Abbott & Harley pipe line

farm. Directors of the company were Henry Harley, W. H. Abbott, Jay Gould, A. R. Williams, J. Douglass, and W. H. Kemble.

In November, 1865, the Oil City-Pithole Railroad Co. began construction of a railroad from Reno to Rouseville and Pithole. The first train was run from Reno to Pithole on March 10, 1866. Capt. J. J. Vandergrift and George V. Forman equipped the Star tank line to carry oil in tank cars and built the Star pipe line from west Pithole to Pithole City to connect with the railroad.

The Venango Transportation Co. oil pipe lines, operating on Oil Creek and Franklin, Pa., was organized in 1863-1864. C. V. Culver, president.

The Rochester & Oleopolis Transportation Co. of Oil City, Pa., laid a 6-inch oil pipe line from Oleopolis to Oil City, Pa., in 1865.

On February 18, 1866, an operator in Ohio was searching for a lost oil well. A windstorm blew away the derrick and other equipment, leaving no trace as to the location of the hole. The well is said to have been good for 25 bbls. a day.

Payne & Martin pipe lines were in operation at Petroleum Center, Pa., in 1866.

The Cherrytree pipe line, from Kane City to Rynd Farm, Pa., was in operation in 1866, and was owned by John Wallace & Co., of Rouseville, Pa.

The Empire Transportation Co. was organized in 1867 and laid a number of short pipe lines from the wells to the railroad on Oil Creek.

Vandergrift & Forman were operating the following pipe lines in Pennsylvania in 1867-1868: Pithole & Paxton, Fagundas & Trunkeyville, Shaw Farm & Oil City, Sandy & Oil City, Miller Farm & Oil City, and Franklin & Oil Creek.

The first free oil pipe line bill was introduced in the legislature of Pennsylvania in 1868, and gave the right of free pipe lines in eight counties of Pennsylvania, as follows: Allegheny, Armstrong, Butler, Clarion, Crawford, Forest, Venango, and Warren, with a proviso that no pipe line should enter Pittsburgh or Allegheny, Pa. This proviso, it is said, was put in at the instance of one railroad to keep the pipe line owners from shipping oil over the Baltimore & Ohio Railroad.

Boat load of oil at Oil Creek, 1865

Many Small Lines Constructed

Stephen D. Karns laid the first pipe line from Parker's Landing, Pa., to the railroad on the opposite side of the Allegheny River in 1868. In the spring of 1869, Fullerton Parker joined Stephen D. Karns in building pipe lines under the name of Karns & Parker Pipe Line. During the summer of 1869, Parker, Thompson & Co. laid a pipe line as a competitor to the Karns & Parker Pipe Lines, and after a year or more of rivalry and competition the two pipe lines were united under the name of the Union Pipe Line.

The Grant Pipe Line Co. was organized at Parker's Landing, Pa., in 1870, Col. R. B. Allen, president.

The Emlenton Pipe Line was laid from Upper Turkey Run to Emlenton, Pa., in 1871.

The Antwerp Pipe Line, from Upper Turkey, Pa., was laid in 1871.

The Octave Pipe Line was organized at Titusville, Pa., in July, 1871; M. Stewart, president; J. E. Blake, vice president; D. O. Wickham, secretary; O. G. Emery, treasurer; D. Emery and L. Emery, Jr., directors.

The Fairview Pipe Line, from Fairview to Karns City, Pa., in 1872.

Relief Pipe Line, from Petrolia, Karns City, and Parker's Landing, Pa., in 1872.

The Butler Pipe Line, from Butler County oil fields to the loading rack on Allegheny Valley Railroad at Parker's Landing, in 1872.

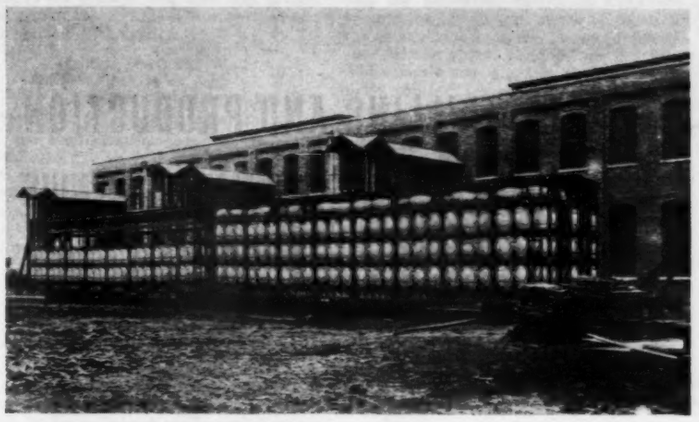
The Cleveland Pipe Line Co., S. D. Karns, owner, from Karns City and Petrolia to Parker's Landing, was laid in 1873.

The Mutual Pipe Line Co., operating in Venango, Armstrong, Clarion, and Butler Counties, Pennsylvania, in 1871.

The free pipe line bill passed both houses of the legislature of Pennsylvania, March 13, 1872. The legislature on March 18, 1872, passed a bill repealing the proviso, which allowed free pipe lines in only eight counties of Pennsylvania.

In 1872 the American Transfer Co. began to build and acquire by purchase pipe lines on Oil Creek and in the lower oil fields. This was the first Standard Oil Co. pipe line.

J. H. Dilks organized the Olean Petroleum Co. in 1873, with headquarters at Olean, N. Y. A pipe line from the Bradford oil field was laid, and on Thanksgiving Day, 1875, the first oil was pumped.



Two cars of barrels ready to go into service

In 1873 the Union Pipe Line Co. acquired a number of pipe lines and operated its system in connection with the Empire Pipe Line.

The legislature of Pennsylvania in May, 1874, passed the pipe line bill, regulating the pipe line companies and ordering them to make monthly statements of runs, stocks, receipts, etc.

In 1874, the Vandergrift & Forman and the Mutual pipe lines consolidated, under the name of the United Pipe Lines.

The growth of the pipe lines up to and including the spring of 1874 was extensive. Short pipe lines multiplied, and one after another was built from the producing wells to the oil refineries and railroad shipping points, and crossed and paralleled one another in every direction. Competing companies waged war upon one another, cutting rates to the point of doing business at an actual loss. When the producer had run his oil into the storage tanks of some of these concerns he was not certain whether the certificates received (for they all issued certificates instead of paying cash for oil) had any value; yet the producer had either to run his oil through the pipe line that was connected to his tank or quit producing the oil. These badly managed competitive pipe line companies were the direct cause of the Vandergrift & Forman and the Mutual Pipe Lines consolidating into one united pipe line system.

DEVELOPMENT OF TANK CARS FROM TUB TYPE ON RAILROAD FLAT CARS STARTED IN 1865

The railroads were vitally interested in the transportation of crude oil in the early sixties. In 1865 the car tank mounted on a railroad flat car, made its appearance. It was called the rotary oil car. A number of the first tanks on cars were constructed of iron but the great majority were built of heavy pine planks, a material more readily obtainable and lower in cost. These tanks were very similar to the small, iron-hooped wooden tanks in use at the wells, being round and of smaller diameter at the top than bottom and holding 40 to 50 bbls. each. On each flat car, two of these tanks were mounted, one at each end over the trucks, making the capacity of the car between 80 and 100 bbls. The first of these rotary oil cars arrived in Titusville, Pa., on November 1, 1865, and it received a cargo of oil at the Miller farm, the terminus of the Van Syckel pipe line. This car was the property of the Eagle Transportation Co. of Philadelphia who owned the patent rights and who proposed to build and operate a tank line on all railroads for the transportation of crude and refined oils.

However, builders and users of tank cars soon began to make improvements in the design and construction. Dillingham & Cole, a firm of machinists with shops at Titusville, in 1866 received a contract for fitting 60 tank cars for the Oil Creek Railroad with a rather ingenious gate valve or cock that could not be opened without having a wrench that was made especially for the purpose. These tanks were constructed of iron and mounted on flat cars at each end over the trucks, similar to those of the Eagle Transportation Co. The capacity of these cars was about 90 bbls. This type of tank car eliminated considerable loss of oil, resulting from leakage in transit and reduced the liability of serious conflagrations.

In the late sixties, the forerunner of the present type of tank car was introduced, a design of car in which a horizontal, cylindrical tank replaced the two small wooden ones. The first of these cars was shipped to the Oil Creek region in 1868. A radical change was made in the designing of these new tanks in that they were fitted with a dome which allowed the oil to expand without injury to the tank. These cars had a capacity of 80 to 90 bbls. Later this was increased to 100 bbls. which became the standard for that period.

In addition to the general improvements in construction detail and the materials going into the manufacture of wooden tank cars, it has been found necessary to deviate from the ordinary type and to construct many special cars to handle petroleum products of unusual characteristics.

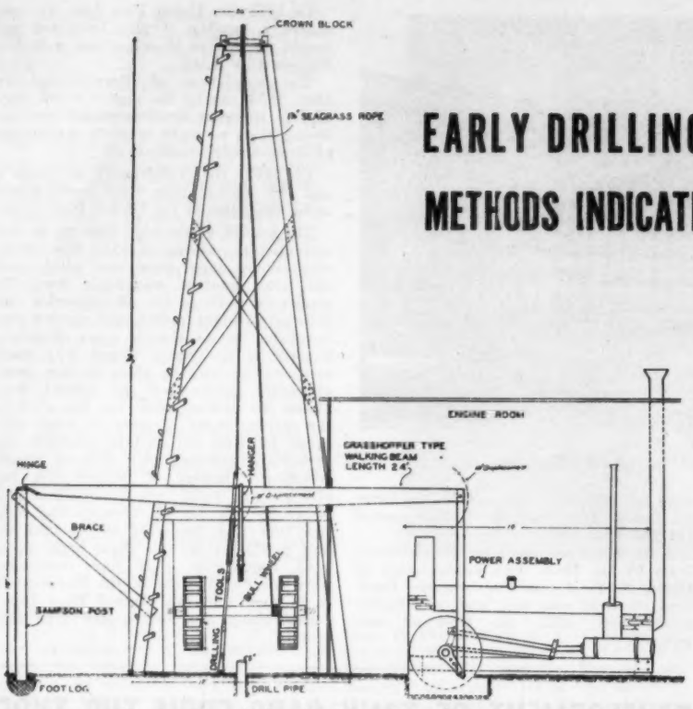
The ordinary tank car of today is double riveted in place of the original single riveted type. The barrel is made of a tougher and heavier sheet of steel and a cast steel side frame has replaced the arched tank trucks. One of the most important improvements in detail has been the replacing of the ring seating type of outlet valve by the positive seating type which promotes safety.

Railroad tank car

Faced with the problem of transporting more volatile hydrocarbons, tank car manufacturers have adopted the use of tank barrels, capable of withstanding high pressures, and where exceptionally volatile products are to be transported, such as liquefied gases, they have designed and put into use multiple tanks which take the shape of large cylinders. In a few instances the products made from hydrocarbon gases are corrosive and it is necessary to transport them in aluminum cars.

The insulated type of tank car has become a standard for use in the natural gasoline industry and it has been given exceptionally close attention in regard to strengthening the truck frame. It has been equipped with more positive acting safety valves and dome covers that minimize the hazards in gauging and unloading.

EARLY DRILLING AND PRODUCTION METHODS INDICATE MECHANICAL GENIUS



Reconstructed assembly of the derrick and equipment used in drilling the Drake well. Data upon which drawing is based were secured from several books written soon after well was completed and from contemporary photographs

DEVELOPMENT—ERA NUMBER 1

To secure a proper background for the study of the development of drilling and producing equipment used in the oil industry it is first necessary that a brief review be made of those major events that led to the drilling of the Drake well in 1859 to secure crude oil from the ground. It is a well known fact that petroleum had been secured from seeps and even from dug wells and from wells drilled for salt brines long before Drake drilled his epoch making hole in Oil Creek Valley in August, 1859. The important fact is that the Drake well crystallized into reality a great many ideas that had been advanced by men in many walks of life as to the need for some form of illuminating oil in quantities large enough to make its use universal.

For ages men had been struggling along with various forms of feeble lights and it was not until the decade before Drake's well was drilled that the use of coal oil had been introduced and the lamps improved to make them really worth while as means of producing artificial light.

For ages men had been securing salt brines by dug or drilled wells to use for the production of salt and the mechanism used for drilling brine wells in this country had been vastly improved and it was not uncommon to learn of wells drilled for this purpose to depths of several hundred feet. These wells were pumped with steam engines and lined with brass tubing so that all of the equipment needed for drilling for crude oil was at hand when Drake conceived the idea of trying this means of securing it.

Pithole, 1865

Salt Wells Suggest Boring

When E. L. Drake was hired to proceed to Titusville, Pa., to make investigation into the oil land that had been secured by George H. Bissell and others he found men there who knew of the salt wells that had been drilled in West Virginia and Pennsylvania from 1808 to 1859 and while his original idea was to recover the oil by trenching near the oil seeps he changed over to the bored hole method.

Having decided to bore for oil Drake next proceeded to have a derrick erected and a pump house built on the premises and he began negotiations for a steam engine and a boiler to furnish power for the work. The reference to "pump house" in this connection seems to have been made because steam engines had been used for pumping brine wells and as this was the first attempt to drill a well for oil the term "engine house" had not at that time been used.

Layout of Drake's Derrick

The derrick was constructed out of pine poles cut near the well site and formed into a structure on the ground and then hoisted or raised by hand power to a vertical position. It was about 12 feet square at the base, 30 to 35 feet high, and about 3 feet square at the top. Pin holes were drilled in one of the corner posts into which round rungs were driven to form a ladder from base to top. This derrick was not boarded up, as shown in the familiar pictures of the Drake well, until after oil was struck.

On top of the derrick a pulley was placed to accommodate the drilling line made from "sea grass" and 1½ inch diameter. The pulley and its shaft were made out of wood and the ends of the shaft fitted with iron gudgeons that rested in holes drilled in the timbers forming the top of the derrick.

Mr. Drake started this work in 1858 and hoped to have drilling under way by September of that year. He ordered an engine and boiler from W. M. Faber & Co. of Pittsburgh, Pa., and the outfit cost about $2,000 f.o.b. factory. The engine was known as the "Long John."

After some delay this outfit was finally shipped by canal from Pittsburgh to Erie and from Erie hauled overland to the location of the well about 1 mile below Titusville, Pa., just over the line in the northern edge of Venango County.

The boiler was of the one-flue stationary type, the flue being near the bottom of the 30-inch diameter by 12 or 14-foot long shell. This shell was erected in a stone setting. Wood was used for fuel. The rating on this boiler was about 10 horsepower, but the working pressure is not reported.

Steamboat Type Engine

The engine was set at the side of the boiler and the steam from the boiler delivered direct into the engine cylinder. This engine was rated at 6 horsepower and was of the same type as used on steamboats on the Monongahela, Allegheny and Ohio Rivers in the fifties. To reverse the engine the eccentric rod was disconnected from the lower end of the rocker arm, which was provided with a pin for that purpose, and by means of a lever at the upper end on the rocker arm the valves were manually operated to admit steam at proper intervals to run the engine in the reverse direction. A bell was hung in the engine room, attached to a cord running to the derrick, and signals were agreed upon for operating the engine, that is, for running it fast or slow, or stopping.

A heavy flywheel was provided with this engine and at the end of the flywheel shaft a crank was attached. On the steamboat this crank imparted motion to the beam driving the paddle wheels. At the Drake well the pitman between this crank and the end of the working beam gave the beam what was called a "grasshopper" motion. The "working beam" as it was then called extended through the derrick to a vertical upright pole set outside of the rig and to this post one end of the working beam was attached. As the crank rotated the pitman would lift and drop the other end of the working beam and give motion to the tools.

After one or two attempts to hire drillers and start the work in the fall of 1858 Mr. Drake drove to Tarentum, Pa., in a sleigh in March of 1859 and on the recommendations of Tarentum men, hired William A. Smith, a blacksmith and driller, who with his two sons, James and Sam, moved to the quarters at the rig that had been provided by Mr. Drake.

The driller who is familiarly known as "Uncle Billy" Smith proceeded to make the boring tools which weighed between 100 and 200 pounds complete, before he left Tarentum because he had better facilities at his old home. Drake furnished the iron needed and Mr. Smith's bill for the labor was as follows:

May 14, 1859

Mr. Drake:

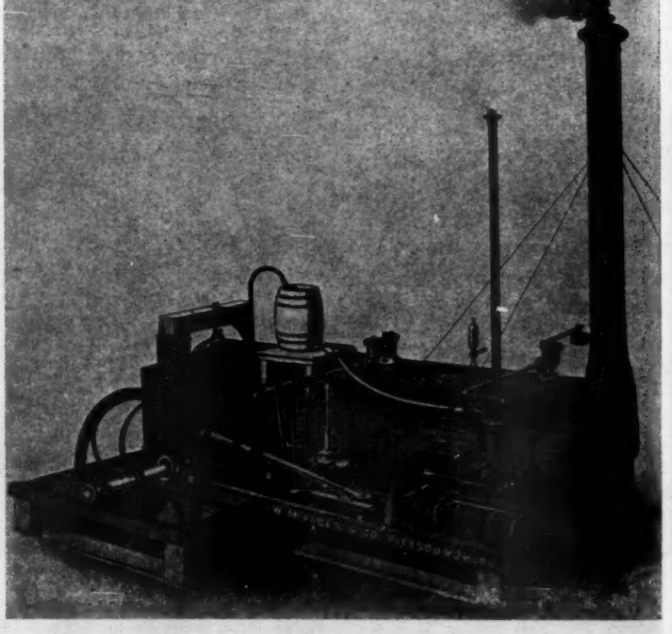
To making boring tools the full set	$40.00
2 spear boxes	2.50
4 spear pins	4.00
16 sucker joints, $1.50	24.00
	$76.50

It is further reported that "Uncle Billy" received $2.50 per day as driller, but no mention is made of the wages paid his helpers.

In drilling this well it was the practice of the driller to first use a chisel shaped bit about 1½-inch cutting edge and with a length of 30 inches fashioned out of round iron and fitted with a threaded joint at the upper end. It was the custom after drilling a while with this bit to run a "rimmer," a tool much like the drilling bit only with a wider cutting edge and heavier.

Cuttings were removed from the hole by running a sand pump made out of sheet iron, riveted and soldered into a short tube, and fitted with a flat leather flap valve in the bottom.

Even though the steam engine was used for drilling it is reported that tools were pulled out of the hole and run in by hand and foot manipulation of a set of "bull wheels" set at the side of the derrick. These wheels were made with a



Type engine and boiler used in drilling the Drake well near Titusville, Pa., in 1859. Engine known as the "Long John" and designed for steamboats

log for shaft to which flat spokes were nailed and to the outer edge of the spokes cants were nailed. Across the space between the cants "cleats" or short strips of lumber were nailed to provide a means for pulling the wheel around by hand or a place into which the foot of the operator could be thrust as he kicked down to give motion to the wheels. To stop the wheels from rolling when the driller was at work at the hole a piece of board was attached to the head board above the bullwheel posts in such a manner as to permit it to drop behind one of the cross pieces on the cants and prevent the wheel from turning. Brakes were not used as the driller and his helper were strong enough to start or stop the wheels and handle the light strings of tools used.

With this setup work of drilling the well started in the spring of 1859 and much difficulty was encountered because the soft surface soil caved into the hole so rapidly that it was not possible to drill the hole to the hard rock.

To overcome this trouble Mr. Drake secured several short sections of cast iron pipe either 4 or 5 inches outside diameter and fitted the lower end of each joint with a wrought iron collar or shoe that was riveted into place. This was used as the first cast iron drive pipe in any type well whether drilled for salt brine or oil.

Driving Pipe

To drive this pipe a wooden ram or maul was rigged up in the derrick at the end of the drilling line so that it hung over the upper end of the section of pipe and would strike it when allowed to fall. The ram was guided by planks and lifted by the men pulling on the drilling line and then quickly letting go. As the pipe was forced into the soil the loose earth inside of it was cleaned out by running the bit and the sand pump or bailer. It is reported that about 3 feet of pipe was sunk each day and by this slow process the bed rock was finally reached at about 39 feet below the surface. The wrought iron bands between joints served to hold the sections together and when all were in place the first conductor or surface pipe was installed in a drilling well.

In this connection it is interesting to note that this same general practice was not followed in drilling the wells started immediately after the Drake well was completed probably because the cast iron pipe was not quickly available and also because of its cost.

Instead of the driven surface pipe it was customary to make a wooden conductor and sink it in a dug hole. The first well to be spudded in without digging a hole by hand for the conductor is reported to have been at a well drilled in Bradford, Pa., Field in 1878. In this Bradford well the hole was dug with a bit and "spudding in" as known at all cable tool wells thereafter, was initiated. After a hole large enough to accommodate round wooden conductor was drilled, the size of the drill used was reduced and the drilled well started.

Drilling the First Well

After the drive pipe suggested and furnished by Drake was in place and seated on the rock stratum found at about 39 feet below the surface the regular center bit was used and 3 or 4 feet of hole drilled daily. The hole was rimmed by using a heavier bit and when completed the hole was lined with a string of brass tubing about 2½ inches outside diameter. This brass tubing was used because it was available and commonly used in salt brine wells to resist corrosion.

By keeping at it all summer "Uncle Billy" Smith and his crew reached a total depth of 69½ feet below the surface on the afternoon of Saturday, August 27, 1859, and shut down operations for the week end as they did no work at the well on Sunday.

But on Sunday morning "Uncle Billy" did visit the well and to his surprise found that it was filled with oil to within 8 or 10 feet from the top. He notified Mr. Drake and got his sons to rig up a small pitcher pump that they had available and they proceeded to pump the oil out of the hole and during the first day's production it is reported that they filled three or four 40-gallon barrels. It is reported that this first oil sold for 50 cents per gallon or $20 a barrel and it is therefore easy to visualize the excitement created when the completion of the Drake well became known.

Well on the Sarah V. Dale farm in Homer Township, Morgan County, Ohio, drilled in 1861 and still producing

Geology of Region

The completion of the Drake well at 69½ feet was probably due to striking a fracture or fissure in the sandstone. This formation was ever after referred to as the "First Sand" or "First Sandrock" and as later wells encountered oil at deeper depths the "Second" and "Third" sandrocks were found.

Later geology of the region around Titusville, Pa., and northern Venango County in the valley of Oil Creek does not make clear the surface formations at the well site. It so happens that this well is located just a short distance south of the Crawford-Venango County line and the geological survey of Crawford County, or the district north of the well shows sandstones of the Pocono group of the Mississippian age at the surface while just across the line the survey reports the surface rocks of the Venango County area in the Oil Creek Valley as Chemung shales of Devonian age. This apparent change in surface rocks is probably explained by the fact that the work in the two counties was done by separate field parties and was assumed to be complete for each county.

In the opinion of modern geologists the so-called "First Sand" in which the oil was found at the Drake well correlated with the Berea sandstone or "grit" of Pocono group, Mississippian series, and of Carboniferous system in the Paleozoic era. It is also correlated with the Murrysville gas sand of Allegheny County, Pennsylvania.

At Pleasantsville, Pa., a few miles east of the site of the Drake well the stratigraphy of Ennis Hill is reported in one of the Pennsylvania State Geological Survey bulletins as follows:

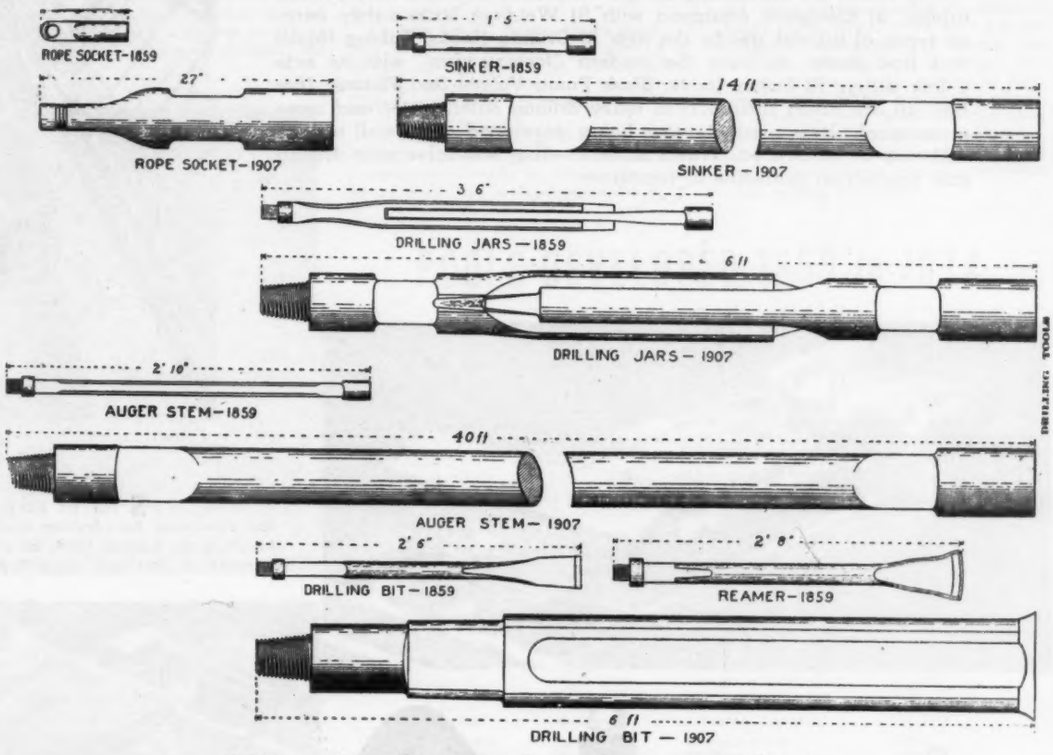
	Feet
Elevation at top of Ennis Hill, Pleasantville, Pa.	1,713
Fragment of Pottsville (Olean) conglomeratic at top.	
Cuyahoga shale	70
First Mountain sand, lower Carboniferous	45
Shales	56
Second Mountain sand, lower Berea grit	45
Bedford and Cleveland shales	231
Third Mountain sand	56
Shales	168
First oil sand	40
Shales	99
Second oil sand	30
Shales	76
"Stray Third"	16
Parting shales	27
Third oil sand	20
Chemung shales, thickness unknown.	
Total thickness of section measured	975

The Drake well did not produce very long, but its completion started a great deal of activity along Oil Creek and up and down the Allegheny River into which Oil Creek empties so that the oil region of Pennsylvania in 1859 and 1860 soon covered a considerable area.

Oil was discovered in 1860 in other parts of Venango County, but principally along Oil Creek; in Butler, Warren and Beaver Counties, and at several places in Ohio and at Burning Springs, W. Va.

It is most interesting to note that oil was also reported as found in a well drilled in Paola, Miami County, Kansas, in 1860 and in the year following, or 1861, in Ventura County, California. In 1862 oil was found in wells drilled at Florence, Fremont County, Colorado, and this field is still producing.

The first field in Russell County, Kentucky, was opened at Creelsboro in 1861 and the second field in Meade County was discovered in 1863. After these initial discoveries in Pennsylvania, Ohio, West Virginia, Colorado, Kentucky and California, oil was discovered in Tennessee in 1866 and in Wyoming in Uinta County in 1867. A second field was found at Wyandotte County, Kansas, in 1870 and by the end of the first 15-year period after the discovery of the Drake well Kansas had a third field at Iola.



Drilling tools used in 1859 and 1907 showing comparative size

This indicates that this method of drilling as demonstrated by Drake caused the discovery of oil fields from one side of this country to the other and in several states in the intermediate area.

The demand for axle grease for wagon trains traversing the western plain states and the mountains created the business of developing oil in Colorado and Wyoming, while California found use for the oil discovered there for lighting the buildings in its towns and cities built following the gold rush of 1849 and for lubrication.

Production Methods

Price has always been a very important determining factor in all oil operations even from the first days of the industry. The wells to be sunk immediately after Drake completed his well were "kicked down" to the First and Second sands and immediately put on the pump. If the operator did not have the price of an engine he operated the pump by hand just as he had used manual labor to kick the well down. But as oil was in demand and the prices high manufacturers of boilers and engines and pumping equipment found a ready market for their output and received good prices. Haste in drilling the hole and then speed in pumping the oil to get it on the market quickly was the keynote of oil operations in the early days just as it has been ever since.

The manufacturers of machinery were

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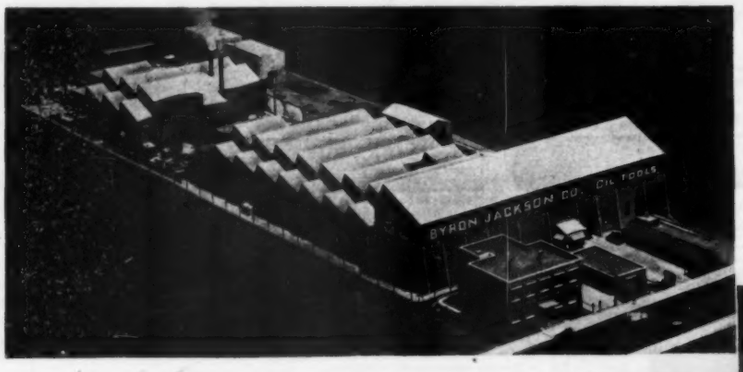

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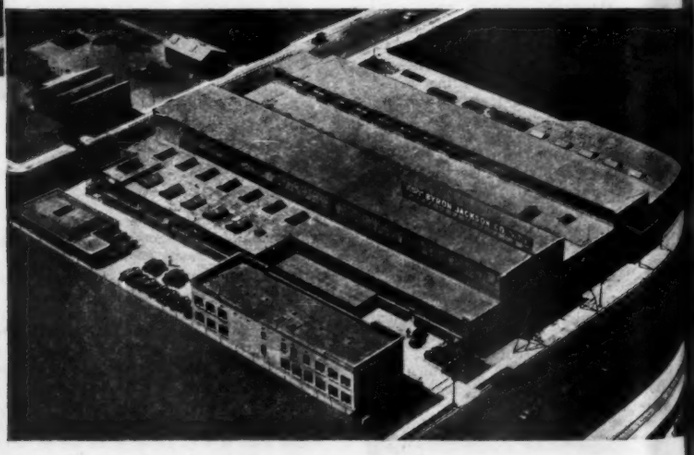

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BJ DRILLING AND PRODUCTION TOOLS

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

quick to recognize this potential market and larger boilers were built and separate steam engines of larger power also made available. In a short time the boilers were increased in rating from 15 to 25 and 40 horsepower and link reversing type steam engines are reported as first made by Messrs. Wood and Mann with cylinders 7"x10", 8"x10" and 8"x12" diameter and stroke. Later the cylinders were increased to 10 and 12 inches by 14 inches long.

The original shallow wells were pumped through the brass tubing with wooden sucker rods actuating a traveling valve in a working barrel such as used in the salt brine wells of that period. The oil was in this manner lifted in the tubing and at first it was permitted to flow over

Oil vats on the Tarr farm on Oil Creek, Pa., as it appeared in 1862. The picture also shows the barreled oil ready for delivery to the refineries

the upper end of the tube into a large cup and from this cup escaped, by means of a wooden trough, to a rectangular shaped tight box placed either at the edge of the derrick or buried in the ground near the rig.

This means of pumping the well did not afford opportunity for lifting the oil very high above the surface but advantage was taken of the topography of the ground around the derrick and if one side of the derrick permitted the barrel to be set below the box on the derrick floor and the oil run into it that served the producer's purpose.

If it was necessary to deliver the oil from the well into wooden rectangular tanks or boxes buried in the ground alongside the rig this was done. The submerged boxes were made out of heavy, matched planks held together and made liquid tight by clamps fastened with keys. These boxes ranged in size from 10 to 250-bbl. capacity and were sunk into dug pits so that only 1 or 2 feet of the upper part of the box extended above the ground level. The top of the box was covered with planks and the planks in turn covered with earth or sod.

The wooden trough, conveyed the oil from the enlarged upper end of the tubing to the sunken boxes and to get this oil out of those boxes and into the barrels used to deliver it to the shipping point at the creek or at Oil City or Erie, pitcher pumps were erected with the spout placed high enough to permit the barrels to be set under it.

The oil was pumped out of the boxes and into the barrels and as long as the shallow wells were the principal producers this simple arrangement sufficed to handle the oil.

Flowing Wells

Men in the oil industry always seemed to be striving to increase the volume of the oil produced and thereby make greater amounts of money in the shortest possible time, but they have always forgotten that no one individual could control a mechanical device exclusively and the result of the new inventions has been to temporarily flood the market with oil.

This condition of overproduction was created for the first time in 1861 when someone conceived the idea that the oil that was being pumped from the shallow sands must be coming from deeper buried reservoirs and if these deeply buried reservoirs could be tapped larger wells would result.

The machinery and drilling technique had advanced to the stage where in May, 1861, A. P. Funk drilled a hole to the top of the "Third" sand at a depth of 400 feet and then drilled in 50 feet before the first flowing well on Oil Creek was completed on the McElhenny farm in Cherrytree Township. This was known as the "Fountain" well and revealed the possibilities of securing flowing wells if the holes were drilled deeply enough.

Immediately thereafter all operators tried to secure flowing wells and many were successful so that overproduction increased but as the wells produced by natural energy from the formation it was soon found that the older type buried rectagular boxes would not suffice to handle the oil. Also it was very difficult to keep these boxes tight and the loss by seepage was appreciable.

This led to the building of the wooden tanks with tapered staves and flat hoops so common to all oil fields in the early days, and still to be seen in many.

The tubing was continued up into the derrick to a point high enough to permit the oil to flow into the top of the tanks. Valves or gates were installed on the pipe so that the well could be shut in when the tanks were filled and this was the first type of well head control on producing wells.

These wooden tanks were made out of native lumber, mostly pine, and were used to handle the oil on the lease. To ship the oil it was necessary to run it into barrels and haul it to barges on the creek. Later the refineries were erected in the oil fields and the oil was then produced into the lease tanks and then transferred by hauling to the receiving tanks at the refinery.

The pipe lines did not enter into the industry until later, and as the actual volume handled daily was limited to a few thousand barrels the method was satisfactory.

Evolution in Equipment

During the first 15 years, or from 1859 to 1874, the methods used in drilling the holes progressed from spring poles to steam drilling rigs all of the percussion tool type. Derricks were made of wood because it was plentiful and handy. Machinery was improved in design and efficiency, but as the wells were not over 3,000 feet deep and were not of the high-pressure type when completed it was not necessary to use very heavy pumping equipment.

Removing the engine from the boiler and then later operating more than one engine from a central boiler constituted the most important changes in pumping wells. This was made possible by iron steam pipe with threaded ends and short couplings being made available in large quantities with the price greatly reduced.

Seed packers and "boots" were used on tubing to shut off water in the early wells. Some time later the rubber packer was introduced and this greatly lengthened the life of wells which had been previously drowned out early by water breaking through from above when the seed bags rotted.

In 1866 Leo H. Nelson forged the first pair of steel lined jars and secured a patent on the process of welding steel to iron which provoked a great deal of litigation because the welding of steel on iron was not new.

Col. E. A. L. Roberts of Titusville introduced the torpedo after the Civil War and after some difficulty in getting operators to try it at first he later enjoyed a good business shooting wells. His method was patented and the practice of "moonlighting" sprung up to avoid payment of royalties.

During this period the first oil well fire occurred at the Drake well when "Uncle Billy" Smith made an inspection of a tank of oil at night using an open lantern for light. This fire burned the first derrick, pump house and boarding house. The derrick and pump house were later rebuilt but the boarding house was not.

The first suction bailer was used in drilling wells in the Titusville district in 1860.

Rig irons of the period were for the most part forgings needed to reinforce wooden parts. Bands to fit over the end of wooden shafts for bull wheels and sand reels. Gudgeons to be driven into the end of the wooden shafts to form journals upon which the shafts turned. The bearings were made for the most part by drilling holes in wood and greasing with tallow. Later cast iron boxes were developed where wear was excessive in the wooden bearings.

POOLS DEVELOPED 1859 to 1874

Year	Province--	State—	Field—	County—
1859	Appalachian	Pennsylvania	Titusville	Crawford
	Appalachian	Ohio	Klondike	Columbiana
1860	Appalachian	Pennsylvania	Crooked Run	Butler
	Appalachian	Pennsylvania	Erie	Venango
	Appalachian	Pennsylvania	Franklin	Venango
	Appalachian	Pennsylvania	Grand Valley	Warren
	Appalachian	Pennsylvania	North Warren	Warren
	Appalachian	Pennsylvania	Oil City	Venango
	Appalachian	Pennsylvania	Smith Ferry	Beaver
	Appalachian	Pennsylvania	Tidioute	Warren
	Appalachian	Ohio	Belden	Lorain
	Appalachian	Ohio	Black (Buck) Run	Morgan
	Appalachian	Ohio	Chester Hill	Morgan
	Appalachian	Ohio	Mecca	Trumbull
	Appalachian	Ohio	Macksburg	Washington
	Appalachian	Ohio	Lisbon	Columbiana
	Appalachian	Ohio	Litchfield	Lorain
	Appalachian	West Virginia	Burning Springs	Wirt
	Mid-Continent	Kansas	Paola	Miami
1861	Appalachian	Pennsylvania	Bradys Run	Beaver
	Appalachian	Pennsylvania	Betula	McKean
	Appalachian	Pennsylvania	Bradford	McKean
	Appalachian	Pennsylvania	Carmichaels	Greene
	Appalachian	Pennsylvania	Colegrove	McKean
	Appalachian	Pennsylvania	Dunkard Creek	Greene
	Appalachian	Ohio	Cow Run	Washington
	Appalachian	Kentucky	Creelsboro (Cruesboro)	Russell
	California	California	Ojai	Ventura
	California	California	Santa Paula	Ventura
	California	California	Wheeler Canyon	Ventura
1862	Appalachian	Ohio	Thomas Fork	Meigs
	Rocky Mountain	Colorado	Florence	Fremont
1863	Appalachian	Kentucky	Meade County	Meade
1864	Appalachian	West Virginia	Volcano	Richie-Wood
	Appalachian	West Virginia	New Cumberland	Hancock
1865	Appalachian	Pennsylvania	Bittenbender	Clarion
	Appalachian	Pennsylvania	Blackshire	Greene
	Appalachian	Pennsylvania	Blair	Clarion
	Appalachian	Pennsylvania	Carrolltown	Cambria
	Appalachian	Pennsylvania	Catfish Run	Clarion
	Appalachian	Pennsylvania	Cherry Run	Clarion
	Appalachian	Pennsylvania	Enterprise	Warren
	Appalachian	Pennsylvania	Mill Creek	Clarion
	Appalachian	Pennsylvania	Northeast	Erie
	Appalachian	Pennsylvania	Pithole	Venango
	Appalachian	Pennsylvania	Pleasantville	Venango
	Appalachian	Kentucky	Long Falls Creek	McLean
	Appalachian	Kentucky	Oskamp	Barren
	Appalachian	Ohio	Williamsport	Columbiana
	Appalachian	Ohio	Fraseyburg	Coshocton
	Appalachian	West Virginia	Ogden	Wood
1866	Appalachian	Kentucky	Sewell	Cumberland
	Appalachian	Kentucky	Bakerton	Cumberland
	Appalachian	Kentucky	Halfway	Allen
	Appalachian	Ohio	.....	Mahoning
	Appalachian	Tennessee	Spring Creek	Overton
	Appalachian	Tennessee	Eagle Creek	Pickette
	Appalachian	Tennessee	Jones Creek	Dickson
	California	California	Petrolia	Humboldt
1867	Appalachian	Pennsylvania	Dennis Run	Warren
	Appalachian	Pennsylvania	Oleopolis	Venango
	Appalachian	Pennsylvania	Shamburg	Venango
	Appalachian	Kentucky	Little Richland Creek	Knox
	Rocky Mountain	Wyoming	Hilliard	Uinta
1868	Appalachian	West Virginia	Horseneck	Pleasants
1869	Appalachian	Pennsylvania	Butler	Butler
	Appalachian	Pennsylvania	Elk City	Clarion
	Appalachian	Pennsylvania	Petrolia	Butler
1870	Appalachian	Pennsylvania	Emlenton	Venango
	Appalachian	Pennsylvania	Fagundus	Warren
	Appalachian	Pennsylvania	Foster	Venango
	Appalachian	Pennsylvania	Fryburg	Clarion
	Appalachian	Pennsylvania	Looper	Clarion
	Appalachian	Pennsylvania	Lucinda	Clarion
	Appalachian	Pennsylvania	Pine Grove	Clarion
	Appalachian	Pennsylvania	Raymilton	Venango
	Appalachian	Pennsylvania	Sandy Creek	Venango
	Appalachian	Pennsylvania	West Hickory	Forest
	Appalachian	Pennsylvania	West Liberty	Butler
	Appalachian	West Virginia	.....	Tyler
	Mid-Continent	Kansas	Wyandotte County	Wyandotte
1871	Appalachian	Pennsylvania	Johnetta	Armstrong
	Appalachian	Pennsylvania	Sugar Creek	Venango
1872	Appalachian	Pennsylvania	Cranberry	Venango
	Appalachian	Pennsylvania	Utica	Venango
1873	Appalachian	Pennsylvania	Concord	Butler
	Appalachian	Pennsylvania	McCrae Furnace	Armstrong
	Mid-Continent	Kansas	Iola	Allen
1874	Appalachian	Pennsylvania	Butler Cross Belt	Butler
	Appalachian	Pennsylvania	Goheenville	Armstrong

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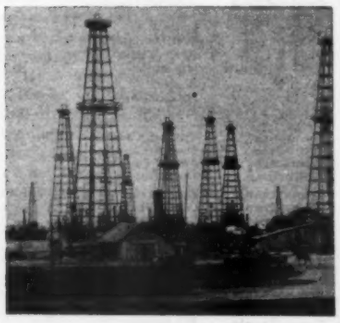

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REFINING OF PETROLEUM ANTEDATES THE COMPLETION OF THE DRAKE WELL

Samuel W. Kier's 5-bbl. refinery at Pittsburgh

REFINING—ERA NUMBER 1

When Colonel Drake first made crude petroleum available from a drilled well on August 27, 1859, he found a refining industry which for several years had been waiting for the production of this raw material in substantial quantities. Petroleum as obtained from the surface of streams, small springs and salt water wells had already passed through laboratories in the United States and foreign countries. Its physical characteristics were definitely known and the chemists of the time had begun to investigate its possibilities from the standpoint of both its scientific and practical value.

From the practical end, it had been subjected to refining processes and it was known that it had value as an illuminating oil or a lubricant. Two or three manufacturers at least were convinced that it was more valuable in these respects than any raw material available at that time and some historians credit this early demand with directing the events which brought about the drilling of the Drake well.

Monitor refinery Oil Creek

A brief summary of conditions in industrial and scientific circles just previous to the Civil War as they apply to petroleum are desirable as a backgground in explaining the remarkable growth of the manufacturing end of the industry following the Drake discovery. James Young in England knew of the presence of petroleum and in 1847 in experimental distillation had secured an illuminating oil, and a lubricating oil. The quantities available, however, were so small that he turned his attention to coal and in 1850 he was issued a patent for refining and treating bituminous coal securing an oil from which an illuminating oil was discovered. This marks the beginning of a period which was to see a rapid expansion in the use of oil for illumination.

This was followed by the establishment of the shale oil industry in Scotland, the oil being refined into several products. Writers of that time trace this industrial development back to discoveries of the ancient alchemists and it is certain that the original distillation units bore a resemblance to the chiemist's equipment of the Middle Ages.

Start of Refining

On this side of the Atlantic we find development closely paralleling those of the European countries. It is said that over fifty American companies were licensed under the Young patents to produce "rock oil" in 1859. Some of these companies purchased the shale oil and oil from coal from English producers and refined them into finished products at plants located in this country. Others produced their own raw oils in this country from both coal and shale.

Dr. Abraham Gessner had treated pitch secured from Trinidad, securing several products, and in 1854 he secured a patent for a coal product which he called kerosene and two years later he was issued another patent for improvements. One of his descendants gives the following explanation as to how the name "kerosene" was adopted: "Paraffine which occurred in the manufacture has a waxy appearance and was formerly called 'tar wax' and it was suggested that Greek words which signified 'wax oil' might form a proper name. Therefore 'keros' meaning wax and 'elain' oil were chosen. At that time camphine, a compound of alcohol and spirits of turpentine, was in use as an illuminator and it was decided to adopt its termination, the public being familiar with it and accordingly 'kerosene' instead of 'keroslain' was decided upon."

This product was first made in this country in 1854 by Dr. Gessner at the works of the New York Kerosene Oil Co. at a place now known as Blissville, near Penny Bridge, on Newton Creek, Long Island, N. Y. This authority states there were 56 works in the United States in 1859 at which kerosene, or coal oil was being refined from coal. Thirteen of these were located in Pennsylvania; New York, 13; Ohio, 12; Kentucky, 10; Massachusetts, 6; and Connecticut, 2.

Another authority states that at the time of the completion of the Drake well there were thirty-five to forty of these coal oil or kerosene plants actually in operation. The significance of this development just previous to the advent of petroleum is twofold: First, the art of oil refining was established on a commercial basis, and second, a rapidly increasing demand was assured for one of the refined products of this oil. These two preliminary developments paved the way for the perfection of refinery processing and expansion of outlets when the new raw material became available. Previous to the Drake well, those connected with the coal business had become enthusiastic as to the possibilities in their industry for the production of coal oil as an illuminator along with certain by-products which already were known to the operators and have since come to play an important part in the chemical industry. Writers connected with the coal industry for a period of 10 years bemoaned the fact that the discovery of cheap crude petroleum quantities had ruined the market for their coal oil and ended an important operating phase of their industry just as it was placed on a sound operating basis.

It is explained by early writers that the country as a whole had reached a point in its economic growth where it was ready for a new kind of illumination. Coal gas had been introduced in the larger cities and this aided in stimulating the demand for better light among people to whom the gas lights were not available. The early coal oil lamp gave poor illumination based on later standards and it was expensive but it was a start in a period which soon found the kerosene lamp in most of the homes of the country.

It is proper at this time to introduce Samuel M. Kier who, one writer predicts, will some day be given a more prominent position in petroleum history than he has had in the past. Before this happens, however, it will be necessary for some investigator to clear up disputed points as to whether Kier's main connection to the petroleum industry was that of vendor of a patent medicine of doubtful value or a manufacturer having an experimental bent whose accomplishments entitle him to be known as the Colonel Drake of petroleum refining.

There is generally agreement among historical writers that Kier and others in 1847 drilled wells near Tarentum, Pa., to secure salt. Some of the wells produced oil which was collected by Kier and his associates. Kier bottled the salty petroleum which had lost its light fractions due to evaporation and sold it as "Kier's Petroleum or Rock Oil"—Celebrated for its wonderful curative powers—A natural remedy — Produced from a well in Allegheny County, Pennsylvania—Four hundred feet below the earth's surface—Put up and sold by Samuel M. Kier, No. 363 Liberty Street, Pittsburgh, Pa. One of these half-pint bottles sold for 50 cents. This product had a wide distribution especially in that section of the country. Petroleum had been sold for its supposed curative properties previously.

Kier in 1849 tried distilling a small quantity of the oil but did not obtain satisfactory results and according to some historians confined his efforts subesquently to selling the petroleum as a medicine and later resumed refining after the Drake oil was made available.

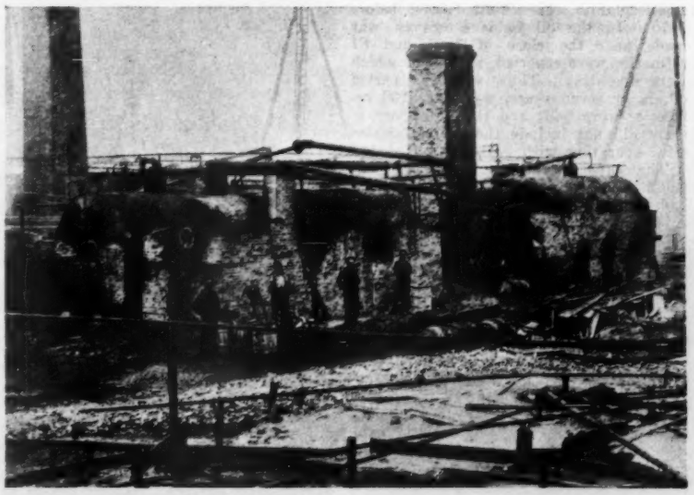
The more commonly accepted story is that Kier, finding his oil production in excess of his patent medicine requirements, which at the peak were less than one barrel daily, started to make investigations as to other possible uses of the oil obtained as a by-product of the salt wells. He submitted samples to Prof. J. C. Booth, a chemist of Philadelphia, who after several tests said that a suitable illuminating oil could easily be obtained from the crude petroleum. Under his direction Kier built a still in Pittsburgh. Thus Profssor Booth might be said to be the first consulting chemist and engineer of the refining branch of the industry.

A larger still was installed in 1855 on Seventh Avenue near Grant Street in Pittsburgh, Pa. It is described as 3 feet, 7½ inches in diameter; 4 feet 8 inches high and 11 feet. 1½ inches in circumference. This still was used to distill the petroleum and and oil called "carbon oil" was sold as a competitor to the kerosene or coal oil. One writer says the new oil did not give satisfactory service in the lamps accustomed to use coal oil and Kier had a new lamp invented and then sold both the lamp and the carbon oil. This oil brought the manufacturers in excess of one dollar per gallon.

Meanwhile Col. A. C. Ferris, head of a firm known as Ferris & Co., had a large kerosene business in New York City with a plant located there. His shale oils and coal distillates for the most part were received from England. He also tried out the crude petroleum and after a time secured a satisfactory substitute for the coal oil and in 1858 the company was taking two-thirds of the petroleum produced by the Tarentum salt wells. Two or three other coal oil companies became interested and they also bought the petroleum from Kier or Ferris.

Buy Drake Crude

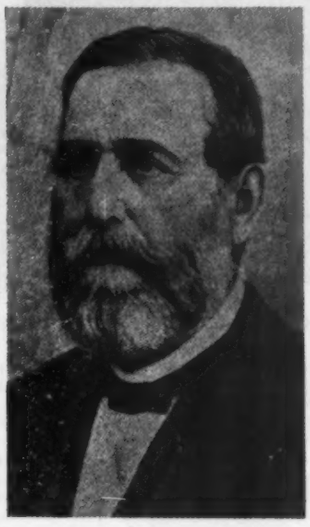
Thus, the stage was set for the entry of crude petroleum obtained from wells drilled for that purpose, starting about September 1, 1859. Kier was among the first buyers of oil from the Drake well paying a reported price of 50 cents a gallon for crude which was sent to his Pittsburgh refinery over the latter part of 1859. Coal oil refiners were also purchasers. Some quickly adapted their plants to distill the new oil but others after an experimental test continued with their former operations until forced to shut down by the low prices which shortly prevailed due to the availability of lower



Reducing stills in operation at one of the first refineries in the Petrolia Field of Canada. View shows equipment built about 1870

cost oil obtained from petroleum. The name of kerosene was quickly adapted by the petroleum refiners for their principal products although there were objections from their competitors obtaining their products from coal and shale.

The refiners who shifted their plants from shale oils and coal oils to petroleum were quickly overshadowed by the first operators who built new plants to operate with petroleum. Little is heard of Kier as a refiner starting at this time. Early in 1860 these petroleum refineries began to appear at many points. Stills were quickly set up near the new wells which were completed, starting in the early part of 1860. Usually they were



SAMUEL W. KIER

located close to Oil Creek and near the few wagon roads which had been built at that time. The problem of transportation for crude petroleum and refinery products was apparent the first year after the Drake discovery. Within a period of five years refiners were giving primary consideration to transportation facilities in locating new plants.

The Barnsdall Refinery

The first oil refinery built in the Oil Creek, Pa., region, was constructed in 1860-61. It was located on the Parker farm on the north bank of Oil Creek, 1 mile below Titusville. The deed for the land, upon which to erect the works, was conveyed by James Parker and wife to William Barnsdall and William H. Abbott, on September 14, 1860. The consideration for the land, 1 acre, was $200. Mr. Parker retained one-fourth of the oil interest in the land conveyance.

On November 6, 1860, work on the new refinery was begun, and on January 22, 1861, the fires were lighted under the still and the refining of oil began in the Oil Creek Valley. The cost of the works was $15,000. The first lot of crude oil that went into the still cost $10 per barrel, and before this product could be placed upon the market, the same crude could be bought for from $2 to $2.50, and still later, for $1.25 per barrel.

The largest nitro shot ever detonated in an oil test was set off in Ed Bateman and others' test near Caddo in Stephens County, Texas, in 1929. Two thousand quarts were shot at once, the test proving dry.

Mr. Abbott had charge of the erection of this refinery, and to get boilers and machinery upon the ground entailed a very great deal of hardship At the time there were no railroads in the region, so everything had to be hauled by wagon from the Allegheny River steamboat landings at the mouth of Oil Creek, 18 miles distant, and Franklin 27 miles away, or from the railroad at Union City, 20 miles distant.

On one occasion two teams, with a number of men helpers, were sent to Franklin to raise partially submerged boilers which lay where they were dumped from a steamboat in the edge of the river. The boilers had been brought there from Pittsburgh. Upon arriving at the place, the teamsters and crew of men looked at the boilers lying in the water, concluded that they could not raise them upon wagons, turned around and returned to Titusville with empty teams.

Mr. Abbott then assumed charge of the work, going himself to Franklin with the teams. As a result, after four days of strenuous labor, the boilers were landed at the refinery.

In 1864, this first refinery and some oil property on the Parker farm were sold to Jonathan Watson, William F. Hansell, Standish F. Hansell, Charles B. Keen, John G. Gillett, and Henry E. Rood, for $50,000.

Many operators were quick to see the advantage of having their plants located in larger cities where they could more readily market their burning oils. The first half of 1860, new plants were reported in Cleveland, Ohio, Erie and Pittsburgh, Pa. Before the year was over there were new plants refining petroleum located along the Atlantic Seaboard at New York City and Boston. The crude was moved in wagons to Erie, several hundred teamsters being employed by 1861 to transport the oil to Erie and other refineries located near the field, including railroad shipping points where the oil in barrels was shipped to Cleveland and other points. These early transportation costs were high and several refiners with plants in these outlying points complained that their petroleum cost from 75 cents to $1 per gallon by the time the crude was delivered at their plants. Efforts were quickly made to reduce these transportation costs and the success or failure of individual operators in a few years was often dependent on their ability to compete in this phase of oil operations. Oil was moved by pipe line in the fields starting in 1865 and this development for a time greatly strengthened the competitive positions of the "refiners in the field" competing with "outside refiners." Within a few years, however, pipe lines were laid to Cleveland, Pittsburgh, and other nearby cities and this fact coupled with special rail rates soon brought numerous complaints from refiners with plants in the fields.

Large Number of Plants

No figures are available showing the total number of refineries at any one time in the sixties. There were more than thirty refineries in Cleveland by 1866, 58 in Pittsburgh by 1864, 30 in Erie during 1866 and more than twenty along the Atlantic Seaboard the same year. Oil was discovered in Canada in the early sixties and more than twenty small plants were built there before 1870. In the oil fields a survey was made near the close of 1867 and 81 refineries were reported, not all of which were operating. Thus, within a period of six or seven years, well over 100 refineries were built and this total apparently did not include the original refineries operating with coal and oil shales.

The capacity of the refineries was small. The 58 refineries in Pittsburgh had a rated capacity of 26.000 bbls. weekly or less than 4,000 bbls. daily. The 81 refineries in the oil region had a weekly capacity of approximateiy 20,000 bbls., or less than 3,000 bbls. daily. Even this small capacity was in excess of needs. Early figures on operations are often somewhat confusing due to the fact that there was no standard size in barrels which ranged from 40 to 55 gallons. In 1866 the standard of 42 gallons per barrel was generally adopted.

Prices for crude oil dropped rapidly starting in 1860 and this also brought troubles to many refiners. Some bought crude at the wells from $10 to $15 per barrel and before they could run it through their plants the finished burning oils were selling for less than the cost of the raw material.

One early day writer gives the following data regarding the cost of crude petroleum and the yields from refining for the four-year period: (Data in gallons).

Year	Production	Ave. price	Total val.
1861	24,060,000	$.06½	$ 1,560,000
1862	40,000,000	.04	1,400,000
1863	70,000,000	.09½	6,650,000
1864	87,000,000	.23	20,010,000
Total for four years.....			$29,620,000

The products of 1864 yielded about 62,000,000 gallons of refined oil, the average price of which in bond at New York was 62 cents per gallon; giving as the value of the refined article in 1864, $40,300,000. Considering that the value of the raw product at the wells was $20,010,000 it appears that the refined product is worth just double the value of the raw oil from which it is derived. This fact illustrates the largeness of the annual gains to labor and capital resulting from the manufacture of petroleum products.

The yield of oil in 1864 as valued at the wells was worth $20,000,000. As the cost of producing the oil is comparatively light it would perhaps be safe to estimate $15,000,000 of this amount as representing the net profit on this return. This gain would be equivalent to a profit of 20 per cent upon $75,000,000 of paid up capital which amount may be considered as about the sum actually invested in the petroleum enterprises in 1864 upon an average for the year.

This estimate as to returns is more favorable than the individual statements of refiners who even in those early days complained of the price of crude oil and the "ruinous competition" in the sale of refinery products consisting principally of three grades of kerosene.

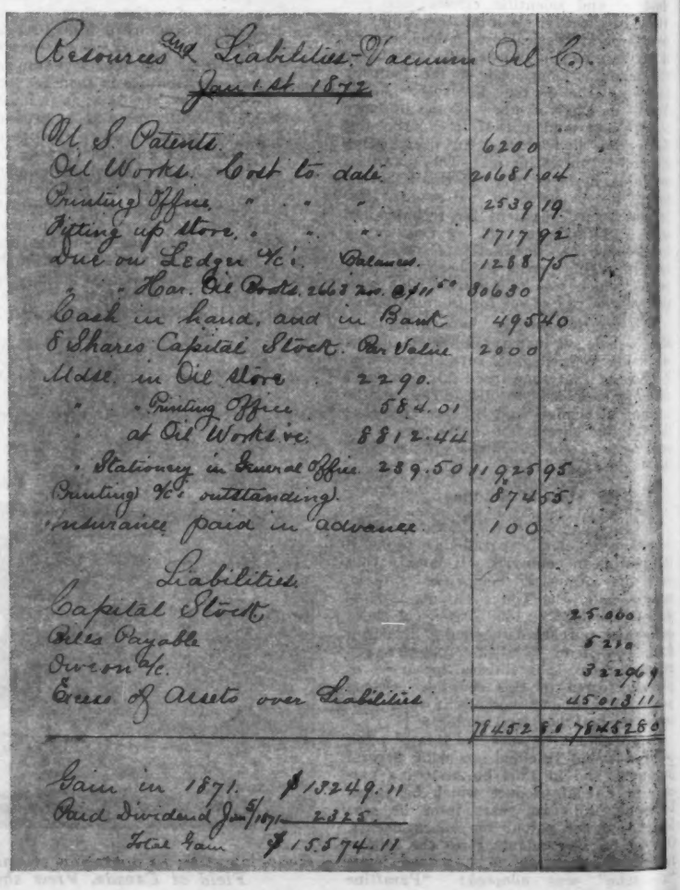
Design of Plants

As previously indicated the early refineries in design followed the construction and operating features borrowed from the coal oil and shale oil refineries. One early refiner explains that he had to increase his condensing capacity due to the fact that the petroleum had light ends not present in the coal distillate. Since these light ends consisted of gasoline which was not salable it is not clear just why he was anxious to enlarge his condenser capacity to recover these as liquid. The early stills varied in capacity from less than a barrel to 100 bbls. J. Walker and associates in 1863 built what was said to be the largest refinery up to that time at Erie. It had a capacity of 100 bbls. daily. The same year William Bannister built a refinery at Erie consisting of two stills each having a capacity of three-fourths of a barrel. An unusual feature of the Bannister operation was that despite the small capacity, part of the output was shipped to England.

Many of these first plants consisted simply of an iron drum of various sizes which were quickly set up and with a condenser the operator was able to secure a distillate which he sold as burning oil. Explosions and fires were reported and several plants never completed their first run. One operator left too much gasoline in his kerosene or distillate and it caused an explosion when sold locally and this in turn resulted in his plant being shut down. Most of these small plants were owned by individuals or partnerships. In many cases these operators were also producers or drillers.

The Steele or Widow McClintock farm, opposite Rouseville, Pa., from which "Coal Oil Johnny" obtained his wealth, was sold by the government in 1866 to satisfy a claim of $11,600 for taxes due on production of oil. It was bid in by the government.

At the same time companies were formed and plans made to operate refineries on a permanent basis. These companies not only erected stills but built adequate storage and permanent buildings and offered steady employment to employes. They made minor improvements in their distillation methods with the view of increasing their yields. The operations of these early plants were similar so far as design and operation was



Resources and Liabilities-Vacuum Oil Co.
Jan 1st 1872

U. S. Patents	6200	
Oil Works. Cost to date	21681 04	
Printing Office " " "	2539 19	
Fitting up Store " " "	1717 92	
Due on Ledger Ac. Balances.	1288 75	
" Nat. Oil Bonds 2663 no. @ 11.50	30630	
Cash in hand, and in Bank	49540	
8 Shares Capital Stock. Par Value	2000	
Mdse. in Oil Store 2290.		
" " Printing Office 584.01		
" " at Oil Works &c 8812.42		
" Stationery in General Office 289.50	11925 95	
Printing A/c outstanding	87 55	
Insurance paid in advance	100	
Liabilities.		
Capital Stock		25.000
Bills Payable		5210
Due on A/c.		32206 9
Excess of Assets over Liabilities		45013 11
	78452 80	78452 80

Gain in 1871. $15249.11
Paid Dividend Jan 5/10/- 2325.
Total Gain $15574.11

concerned as shown by the descriptions now available. The following description by the owners of the Economy Oil Works, Oil City, Pa., in 1865, and written at that time is more complete than those available from other sources and gives a comprehensive explanation of refinery practice at that time:

Typical Operation

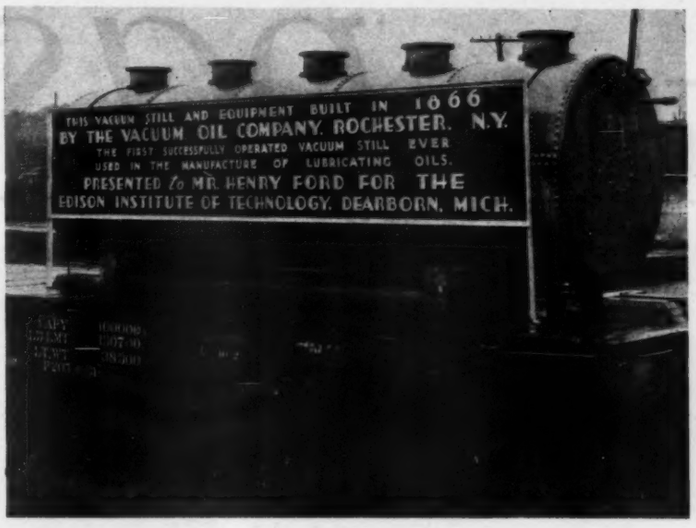
"The first process in distillation is to pump the oil from the crude oil tanks into the stills. The stills range in capacity all the way from 10 bbls. to 100 bbls. each, in the different refineries. These stills are made of heavy boilerplate iron, capable of withstanding a high degree of heat. The liquid, or oil, is then subjected to a degree of heat necessary to bring it up to the distillation point, which commences at 180° F., increasing as the distillation progresses, to 1,000°. From 24 to 36 hours are required to run off the charge of contents of a 100-bbl. still, after the fire is started in the furnaces under the still or retort. As the oil evaporates under such powerful heat, it passes from the retort into condensers attached to same—these consisting generally of long iron tubes or pipes. The condensing pipes are immersed in a current of cold water, which causes the vapor to return to a liquid condition. On emerging from the tube, the separation of its products is made. The first product of distillation is gasoline, of 70 to 72°, Beaume. The second product is benzine, which is 62 to 65° Beaume. At this state, the oil has a bluish white color, instead of its natural dark green.

"From the condenser it next passes into a receiving tank, the oil in this stage being called distillate. Out of this it is transferred, without any further change, into the treating tank, or agitator. This is of sufficient size to allow

Samuel Smith with his arm resting on Drake well which he helped to drill

the mixing of the oil thoroughly with sulphuric acid (oil or vitriol). The quantity of acid used is usually from 1 to 2 per cent. This is poured in, and the whole mass stirred or agitated by means of iron paddles, or a blast of air in the bottom of the vessel, for about ten or fifteen minutes. The object of this process is to separate from the oil all foreign ingredients, such as tar, dirt, or other impurities that may have become mingled with it. These settle down on the concave bottom of the vessel by their own greater specific gravity, and are removed separately.

"The oil is next washed with clean water, and agitated afresh for a period of fifteen or twenty minutes, this process being repeated several times, so as to remove from it every particle of acid. After washing, it is treated with a solution of caustic soda, standing at 12° to 15° Beaume; in the proportion of one-half to 1 per cent. The alkali gives the oil brilliancy, and removes every particle


THIS VACUUM STILL AND EQUIPMENT BUILT IN 1866
BY THE VACUUM OIL COMPANY, ROCHESTER, N.Y.
THE FIRST SUCCESSFULLY OPERATED VACUUM STILL EVER
USED IN THE MANUFACTURE OF LUBRICATING OILS.
PRESENTED to MR. HENRY FORD FOR THE
EDISON INSTITUTE OF TECHNOLOGY, DEARBORN, MICH.

of acid that may have remained in it. Next, it is drawn off into the bleachers or settling tubs, which are large shallow wooden tubs metallic lined. The liquid has now a whitish or bluish white color. Weighed by the hydrometer, this instrument is found to rest at the point marked 45° to 47° on the scale, sinking to the level of a higher figure in proportion to the lightness of oil. It remains in the bleacher, until the gaseous and lighter portions of the oil have evaporated to an extent that the oil will stand a fire test of 110° F and upward without igniting, when a lighted match is applied to it. From the settling tanks or bleachers, it is drawn off and barreled. The barrels are made of the best white oak, the inside of the barrels being carefully coated with glue, or other suitable compounds, previous to being filled. This process is repeated each time the barrels are refilled, the old coat being removed my means of a jet of steam.

In 1907, the Standard Oil Co. was fined $29,240,000 for alleged violation of the law against accepting rebates from railroads. The court order was set aside later.

"After distillation, as before stated, the second liquid that comes off is naphtha, or benzine, or a very light, volatile and inflammable substance, its hydrometrical test varying from 65 to 75 degrees. When the discharge coming from the condensers descends to 60 or 62 degrees, the benzine is cut off, and let run to oil. If cut off at 65 to 75 degrees, the oil will be of inferior quality, inflammable, and insufficient to stand the fire test, being liable to explode. The standard now adopted for refined oil requires it to stand a fire-test of 110° and upward; this being specified in all contracts.

Fire Test

"The mode of determining the fire tests, is by placing a small quantity of the oil taken from the bleacher in a metal cup. Heat is applied by means of the flame of a lamp beneath it. A thermometer is immersed in the oil, and from time to time a lighted match is applied to the oil. The point or degree marked upon the scale of the thermometer at which ignition takes place, is the fire test. When the oil is too inflammable to come up to the standard stated, it is allowed to remain in the bleacher until further evaporation takes place, sufficient to bring it up to the requisite point. Oil that ignites below the specified standard is in danger of igniting when placed in a lamp, causing it to explode, since a certain portion of heat is communicated to it all through from the flame above. The point of ignition is between 110° and 120°, in the best qualities of refined petroleum. It may happen, however, that in consequence of its more rapid heating by some than by others, this standard will vary, the difference between the figures in testing the same sample running from 1 to 5 degrees. There are three grades of refind oil—'Prime White,' 'Standard White,' and 'Straw Color.' such being their commercial classification. All these are required to stand a fire test of 110° and upward. The residuum from the condenser is tar, the average ratio of which to all others is estimated to be above 1 per cent. This substance is used for fuel, as a substitute for pitch, and a lubricating oil for heavy machinery is also made from it. The average percentage of refined obtained from crude petroleum is about 66 to 70 per cent."

While this operation appears simple and cumbersome when compared, with the more involved equipment of today, it contained all the essential skimming practices and was not materially changed for several years. In fact, this operation is largely duplicated in some of the small skimming plants which have been built in East Texas and West Texas during the past few years.

While most refiners in this period confined their operations to the distillation of overhead burning oils, several began to experiment in the production of lubricants. While all Pennsylvania crudes located in the Oil Creek area are now known to have high value in the manufacture of lubricants, the early refiners and producers began to recognize certain crudes as being superior to others for this purpose. Crudes from certain wells were known as lubricating oil crudes, and the producers soon attempted to secure premium prices for their oils.

Early lubricating oil consisted in removing the light fractions from the crude by distillation and then reducing the topped crude to a certain viscosity and sold as what is known as steam refined stocks. Steam was used in reducing these oils to avoid overheating. Later the oil was acid treated and rerun with naphtha.

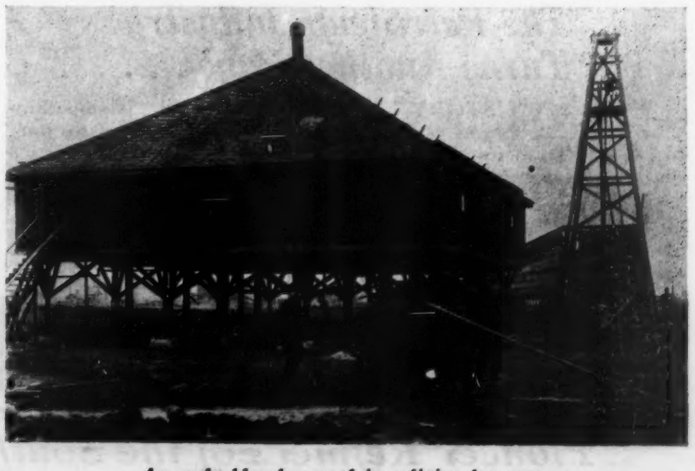
About 1865 they began to finish overhead oils as lubricants for use by industries where more refined oils than cylinder stocks were required. One writer describes an early operation as follows: "In the Corry, Pa., works, after going through several processes, the oil is placed in a room which is a temporary refrigerator, the temperature being reduced to a very low degree by salt and ice. In a short time the oil becomes a thick slush in which condition it is put into strong canvas bags and subjected to a powerful pressure by which the pure oil is forced through the coarse cloth leaving the paraffin inside. In this condition it is shipped to Boston where it is refined into the pure article of commerce."

Thus we have the start of the modern dewaxing operations in the manufacture of neutral oils. This operation was rapidly expanded and perfected with mechanical improvements and within a period of a few years there were several refineries in Pennsylvania manufacturing a complete line of industrial oils. They also manufactured several medicinal products.

Reports covering the period between 1870 and 1874 show that the tendency was toward fewer and larger refineries. Small plants were consolidated and in some cases this meant the dismantling of the smaller plants and the construction of one large plant with bigger stills and generally more efficient plant operations. In Cleveland, John D. Rockefeller and associates succeeded in merging most of the plants located in that city under one management. One of the Standard plants there in 1872 was reported to have a crude oil capacity of 1,500 bbls. daily.

In 1882, Rial & Co.'s No. 9 on the Point Bluff at Franklin brought up a liquid resembling oil in color, but was discovered to be beer. It was found the well was directly over the storage vault of Grossman's brewery and that the drill had penetrated the vault filled with beer.

Construction of refineries in several foreign countries closely followed developments in this country. Exports of crude oil and refinery products during this period required about 40 per cent of the total supply available in this country. Shale oil plant operators and those distilling oil from coal bought the crude petroleum but new plants were built in England, Germany and other points. These plants were similar in capacity to those in the United States. Russia, which was finding its own crude oil supplies, was developing a refining industry of its own.

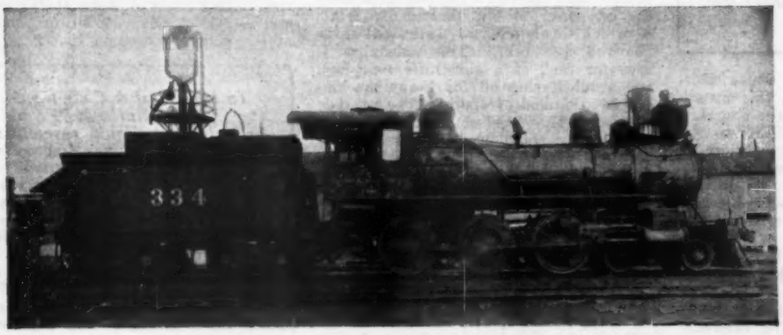


An early bleacher used in refining kerosene

A HISTORIC *past*

Shortly after the discovery of oil at Corsicana, founders of the Magnolia Petroleum Company built the first refinery in the Southwest and the second west of the Mississippi River. Above: Magnolia's first refinery at Corsicana nearing completion in 1898.

When this well was begun in 1895 by the American Well and Prospecting Company, they wanted water. Instead it produced oil. It was this accidental discovery of oil that started the Corsicana development and led to the founding of the Magnolia Petroleum Company.



Fuel Oil was first adopted for railway use when the H. & T. C. R. R. converted this early locomotive into an oil burner in 1901. However, Dr. M. P. Cullinan, brother of Magnolia's founder, had tested fuel oil on a Cotton Belt passenger engine running between Corsicana and Hillsboro in 1898. The fuel oil was furnished by Magnolia's refinery at Corsicana, then the J. S. Cullinan Company.

A PLANNED *future*

The Petroleum Industry Turns Another Page . . . .

"HISTORY," as the small boy said, "is something you read about and wish it happened to you." To many of the present executives of the Magnolia Petroleum Company, making oil history has been a part of their lives . . . they remember the discovery of the first oil in commercial quantities at Corsicana . . . they remember the first refinery in the Southwest because they built it at Corsicana in 1898 . . . they remember fueling the first oil-burning locomotive.

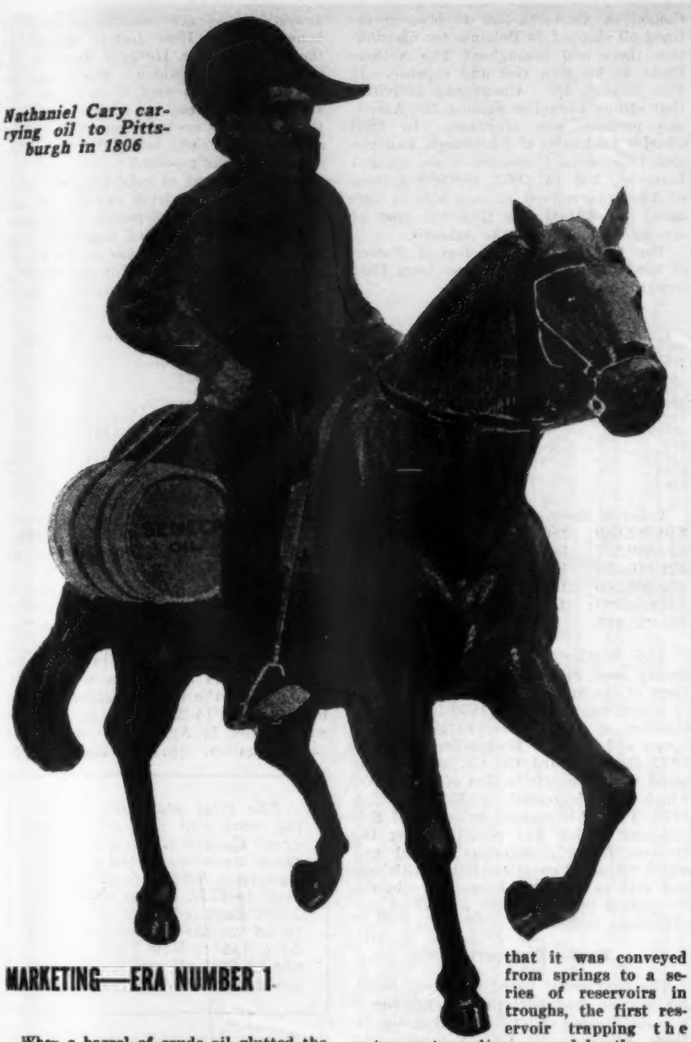
The fledging of thirty-six years ago has grown into a business of world-wide importance. Today as a part of the great Socony-Vacuum Company, Magnolia is pushing on to new and higher peaks of achievement . . . constantly improving their products . . . broadening their market . . . zealously cherishing the faith and good-will which is the public's reward for a job well done.

MAGNOLIA PETROLEUM COMPANY

A SOCONY-VACUUM COMPANY

Pioneer Refiners of the Southwest — *1898-1934*

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.



Nathaniel Cary carrying oil to Pittsburgh in 1806

DEVELOPMENT OF OIL LAMP STIMULATED MARKETING IN THE EARLY DAYS OF OIL

MARKETING—ERA NUMBER 1

When a barrel of crude oil glutted the market in Pittsburgh, there were scholars who knew, in an absent-minded fashion, that petroleum had illuminated homes in 500 B. C., and that its uses in the time of Herodotus, the father of history, ranged from the production of exceedingly durable mummies to waterproofing of cisterns, silos and ship hulls; binding of building stone in Babylon, and application in the arts of the painter and apothecary. In 505 A. D. the streets of Edessus were illuminated by oil lamps, and St. Jerome speaks of Jerusalem similarly lighted. Cicero, in 696, wrote his letters by the light of blazing oil saturated rags, and in 904 the attack on Thessalonica was repulsed with destructive effect upon the aggressors by a rain of "Greek fire" made from petroleum.

For those who are mindful of the early hardships encountered by the pioneers on Oil Creek and disposed to depreciate the commercial significance of petroleum before the modern era, a brief review of the pre-scientific period may be of interest. The first concession for "collection of petroleum" was granted in 1400, in Italy, and 15 years later the utility of oil for street lighting was recognized in London. Germany, in 1436, had its Bavarian petroleum which was sold as a medicine under the name of "St. Quirinus Oil." Pechelbronn petroleum was skimmed from water in 1498 and marketed as a lubricant and an illuminant. In Galicia petroleum was known as "earth balsam" in 1506. Use of petroleum of Modena in 1640 was extended from lighting and medicinal purposes to preparation of varnishes and paints in Italy. It is recorded that Olearius in 1656, in a journey from Germany to Persia, saw 30 petroleum springs near Scamachia, west of Baku.

Jonas Hanway, in 1754, wrote at length on the petroleum of Baku, saying that it was conveyed from springs to a series of reservoirs in troughs, the first reservoir trapping the water content. It was used by the poorest class for illumination and fuel, but imparted a bad taste to the food. The oil was found to be more easily utilized as fuel by admixtures with ashes. A white variety of "nafta," Hanway said, was collected on the peninsula of Apscheron, and was "of much thinner consistency than black nafta."

The Russians (and Persians), he reported, "drink it both as a cordial and medicine, but it does not intoxicate. Externally applied, it is of great use in scorbutic pains, gouts, cramps, etc., but it must be put to the part affected only, as it penetrates instantaneously into the blood and is apt for a short time to produce great pain. It also has the property of spirits of wine to take out greasy spots in silks and woolens, but the remedy is worse than the disease, for it leaves an abominable odor. They say it is carried into India as a great rarity, and, being prepared as a japan, it is most beautiful and lasting of any that has been yet found."

Mention is made of Oil Creek, in Venango County, Pennsylvania, as early as 1789, when the Massachusetts Magazine reported that soldiers had found the oil beneficial when applied on rheumatic joints, and effective as a mild purge when taken internally with the water. It was here that Nathaniel Cary, between 1800 and 1808, gathered petroleum and carried it to Pittsburgh on horseback in two 5-gallon kegs to sell to the druggists as "Seneca Oil." In 1843 Bushrod Creel sold oil from his farm on Hughes River, Wirt County, W. Va., to Bosworth, Wells & Co. of Marietta, Ohio. Dosage prescribed for Seneca Oil was three teaspoonfuls three times a day for cholera morbus, liver complaint, bronchitis and consumption. In 1819, Dr. S. P. Hildreth, of Marietta, reported that "petroleum is beginning to be in demand for lamps for work shops and manufacturers. It affords a brisk clear light when burned this way and will be a valuable article for lighting the street lamps in the future cities of Ohio."

Dr. Benjamin Silliman, editor of the American Journal of Science, in 1822 said that the petroleum of Barbadoes "is very useful in preventing lockjaw, when first symptoms are attended to, by rubbing the spinal column from end to end. Taken internally it is a powerful sudorific." In 1833 the doctor redistilled naphtha in a glass retort and used the product to preserve metallic potassium and sodium. He noted that these metals oxidized slowly in the naphtha bath.

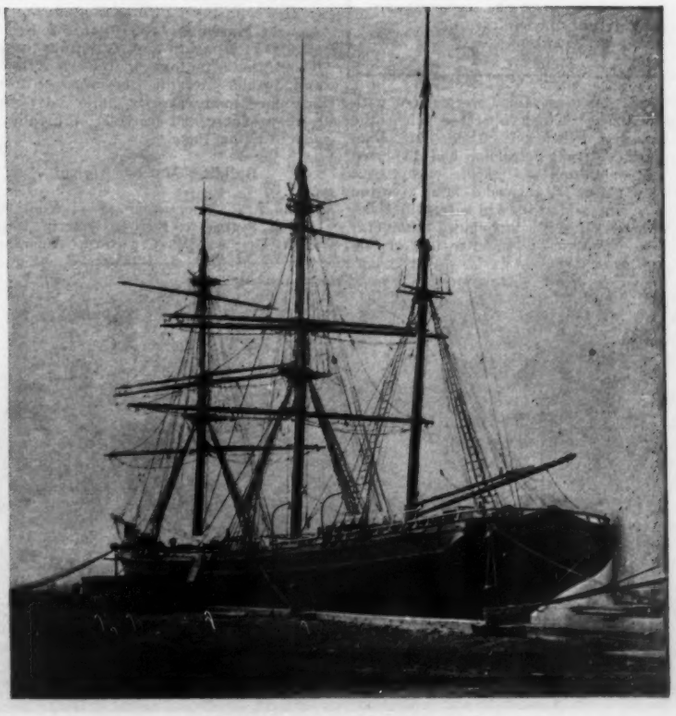
Use as an Illuminant

Samuel M. Kier, in 1842, submitted samples of Tarentum crude oil to Prof. J. C. Booth of Philadelphia, who recommended offering the product to a New York gutta-percha company. Experiments proved unsatisfactory, and Professor Booth then suggested illuminating use and furnished Kier with drawings for a still. In 1845 Lewis Peterson, Sr., of Tarentum, Pa., contracted to furnish 2 bbls. of crude oil per week to the Hope cotton factory at Pittsburgh for use as spindle lubricant, and continued to do so for 10 years.

The first modern oil lamp was invented in 1850 by Adolph Schreiner in Vienna. It is interesting to note that while A. and D. Gordon, in 1822, patented use of platinum, gold, silver or copper wicks made from drawn threads, or glass drawn into capillary tubes and bound into bundles, early writers state that wicks in the lamps used by the vestal virgins, were similary constructed. Oil lamps for street lighting were used in Paris in 1745; in New York in 1762; in Genoa, Parma, Borgo and San Donnino, Italy, in 1802. The Vienna lamp, according to a report in 1866, was introduced in the United States in 1860.

Candles made of fossil paraffin wax, according to the Aerztliche Intelligenzblatt of Munich in 1869, had been used for centuries in Molden and Galicia. Karl Freiherr von Reichenbach, who is credited with discovery of this material in oils in 1830, named it after parum and affinitas because of its inertness. Paraffin had been found in oils earlier, however, by John Nep. Fuchs, in 1809, and by Andrew Buchner, Sr., in 1819.

The outdoor gasoline reservoir burner which years ago was a familiar sight outside the medicine man's tent, was invented by Read Holliday in 1848. In 1852, Stobwasser of Berlin introduced an Argand burner for use with coal oil, and a flat burner for lignite oil. In 1853, Galician petroleum replaced candles for lighting the station of the Emperor Ferdinand's North Railway. Dr. Abraham Gesner, in 1854, patented an improved illuminating oil from coal and named it "kerosone." In this same year the North American Gas Light Co. began to produce kerosene at its plant on Newton Creek, Long Island, N. Y. In 1856 it was reported that the queen's palace in London had been lighted for many years by the "Torbanehill mineral" which



Sailing vessel carrying case oil

was "75 per cent pure oil and the remainder clay." Ten thousand tons of the mineral had been sent to London in 1855.

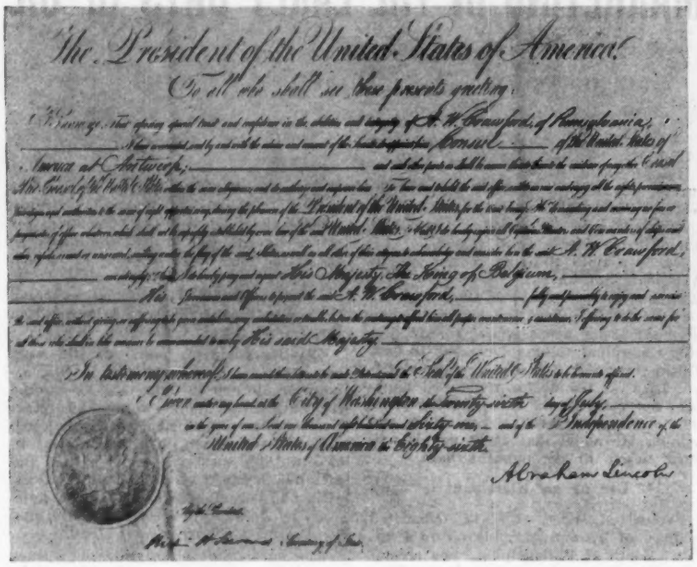
Low Cost of Lighting

Edmond Becquerel, in 1858, compared costs of illumination as follows on basis of 350 candles: Coal gas, at $1.60 per M. feet, 35c; oil (rapeseed) at 17c a pound, 65c; stearine candles, at 32c a pound, $2.52; wax candles, at 52c a pound, $3.12, and electric light (using zinc and platinum battery), 58c. In 1859 more than 40 patents were issued in the United States for petroleum lamps, burners, and related appliances. In that year the output of coal oil totaled 22,750 gallons daily in the United States, and the indicated consumptive demand, in 1,800,000 lamps on a basis of 4 gallons per lamp per year, was 20,000 gallons daily.

Commenting on the exportation of petroleum, the New York World in 1866 said that the exports that year were valuel at $20,000,000 or nearly enough to pay the interest on the bonds of this country then held in Europe.

In 1862 kerosene lamps were fitted with extinguishers which operated when the lamp was tilted. In 1863, Dr. John Draper said that petroleum had displaced all other means of lighting except gas. Joshua Merrill's benzene lamp (cotton filled) was a step toward safety in 1866. In 1869 Merrill introduced "mineral sperm oil" which had a fire test of 300 degrees Fahrenheit. Throughout this period there was strong agitation against petroleum kerosene in lamps, and while attacks based on the explosive nature of some of the materials sold were justified, there were men of medicine who assailed kerosene as the cause of diseases ranging from diphtheria to bubonic plague.

Before proceeding with the growth of utilization of petroleum and its products, it may be well to review the market activities of the years following 1859.



The President of the United States of America:

To all who shall see these presents greeting:

Know ye, That reposing special trust and confidence in the ability and integrity of A. W. Crawford, of Pennsylvania, I have nominated, and by and with the advice and consent of the Senate do appoint him ——— of the United States of America at Antwerp, ——— and do authorize and empower him to discharge and perform all the duties thereunto belonging, and to enjoy all the rights, privileges, and emoluments to the same of right appertaining during the pleasure of the President of the United States for the time being. In testimony whereof I have caused these letters to be made patent, and the seal of the United States to be hereunto affixed.

Given under my hand at the City of Washington the twenty-sixth day of July in the year of our Lord one thousand eight hundred and sixty-one, and of the Independence of the United States of America the eighty-sixth.

Abraham Lincoln

By the President:

Wm. H. Seward, Secretary of State.

Certainly the outstanding feature of the period 1859-1874, from the marketing standpoint, was the exploitation of foreign fields in competition with products from Russia, Rumania, Sumatra, etc. The first oil contract of importance antedates the Drake well by a year. On February 11, 1858, MacKeown and Finley of Pittsburgh contracted to sell two-thirds of their output of "carbon oil" to A. C. Ferris & Co., of New York, at 60 cents a gallon, and on July 7, the remaining third, less 2 bbls. weekly, was included in the contract and the price advanced to 75 cents a gallon. It is interesting to note that each oil invoice sent out by the Ferris company covered a small quantity and was accompanied by a lamp of the company's own manufacture. It was on March 4, 1858, that the Ferris company brought the Tarentum crude oil to the attention of Luther Atwood and Joshua Merrill, who were later to introduce many greatly improved petroleum products and methods of obtaining and utilizing them.

Building Market Abroad

The first exportation of oil from the United States to Europe was in 1861, when Dr. A. W. Crawford, American Consul at Antwerp, had 40 bbls. of refined oil shipped to Belgium for distribution there and throughout The Netherlands, at his own risk and expense. It was through Dr. Crawford's activities that strong prejudice against the American product was overcome. In 1860 Charles Lockhart, of Pittsburgh, had visited Europe to introduce crude oil and kerosene, but in 1862, 588,000 gallons of American refined oil were sold in Germany for $2,000 less than the cost of transportation across the Atlantic.

The United States Geological Survey of 1883-4, gives export figures from 1864 onward, as follows:

Fiscal year ending—	Crude (gallons)
1864	9,980,654
1865	13,293,897
1866	16,057,943
1867	7,344,248
1868	10,029,659
1869	13,425,566
1870	10,403,314
1871	9,859,038
1872	13,559,768
1873	18,439,407
1874	17,776,419

Value of these exports by years: 1864, $10,782,689; 1865, $16,563,413; 1866, $24,830,887; 1867, $24,407,642; 1868, $21,810,676; 1869, $31,127,433; 1870, $32,668,960; 1871, $36,894,810; 1872, $34,058,390; 1873, $42,050,756; 1874, $41,245,815.

Any treatise upon the petroleum industry must discuss at length the operations of the Standard Oil Co. the nucleus of which was formed in 1870 in the combination of Rockefeller, Flagler & Andrews and William Rockefeller & Co. In 1872 the Standard Oil Co. was reorganized with a capitalization of $2,500,000 which was increased to $3,500,000 in 1875. The all-important influence of this company, which was pitted against the greatest financial interests abroad and which attracted countless bitter criticisms and attacks at home, looms large in the succeeding periods in the history of the petroleum industry.

Tanker Transportation

The first vessel fitted with iron tanks for marine transportation of petroleum was the wooden ship Charles, Belgium, in trade between the United States and Europe in 1869. The first steamer built especially for use as an oil tanker was the Vaterland in 1872. First export of American kerosene to Japan was in 1872, and totaled 41,470 gallons. In this year 16,000,000 gallons of Baku oil were sold at 7 to 8 pence a ton, and 600,000 gallons went for 80 pounds sterling.

Other dates of interest in the first period in the story of marketing of petroleum and its products are the following: In 1815, Taylor in England prepared oil gas by passing oils through highly heated pipes, and in 1820 the Taylor-Martineau oil gas making process was introduced. The manufacture of kerosene from cannel coal dates back to 1694, according to English patent records. In 1850, Professor Simpson used a light petroleum naphtha in the place of chloroform as an anaesthetic in the removal of necrosed bones, and in 1866 Joshua Merrill, at the request of Dr. Henry J. Bigelow, obtained rhigolene which was named by Dr. Bigelow who used it as a local anesthetic by freezing tissue with it. Rhigolene produced a temperature of 10 degrees Fahrenheit below 0 degree Fahrenheit, it was reported.

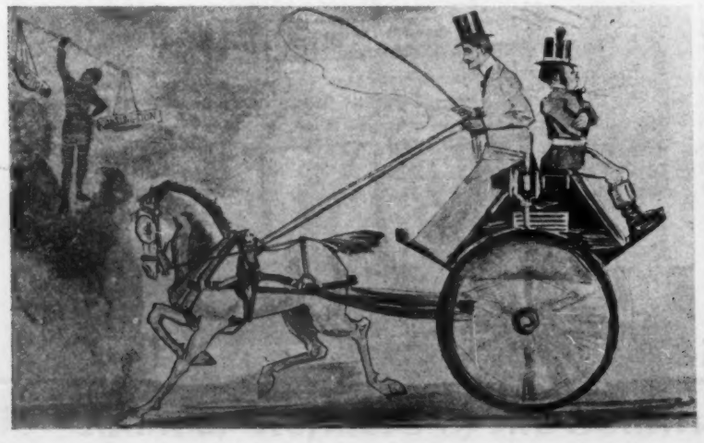
In the interest of coherence, the early utilization of petroleum and its products in motor vehicles and vessels of all types, and the development of engines bearing upon the marketing phase of the oil industry, will be reserved for discussion in the second period. In this first period the way for rapid progress in motive power was prepared, and in the third period petroleum's greatest markets became established.

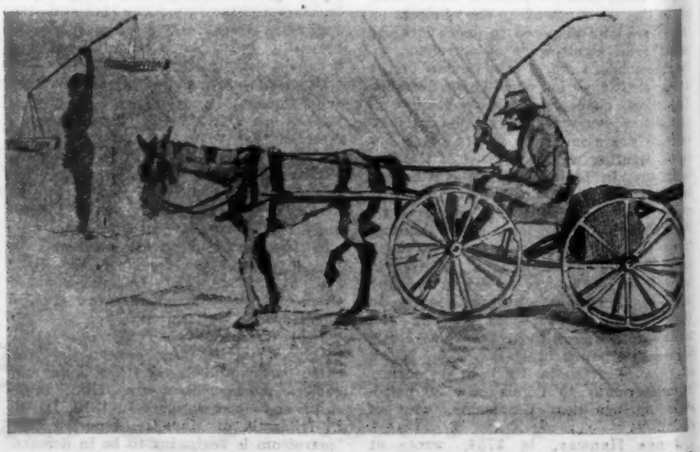
Light naphtha	Illuminating	Lubs	Residue
438,197	12,791,618	.....	.....
460,947	12,732,905	.....	.....
673,477	24,255,921	.....	.....
224,576	62,686,657	.....	.....
1,517,268	67,909,961	.....	.....
2,673,094	84,403,492	134,532	.....
5,422,504	97,902,506	6,871	.....
7,209,592	122,606,955	59,632	156,474
8,092,635	122,539,576	541,419	438,198
9,743,593	158,102,414	748,699	781,074
9,737,457	217,220,504	1,244,305	1,827,791

Reviewing prices of petroleum and refined oil in this first period we find that the first quotations of refined oil in New York were in September, 1860, at 70 cents to 75 cents a gallon. In 1862 prices favored buyers as supplies were abundant, and by the end of January refined oil was down to 28 cents a gallon. Low was reached in April at 15 cents to 18 cents a gallon. On September 1, 1862 the Government levied a tax of 10 cents a gallon on refined oil, exempting oil for export. Refined oil average prices by years were as follows: 1863, 44¾ cents; 1864, 64¾ cents; 1865, 58¾ cents; 1866, 42½ cents; 1867, 28¾ cents; 1868, 29⅛ cents; 1869, 32¾ cents; 1870, 26⅜ cents; 1871, 24¼ cents; 1872, 23⅝ cents; 1873, 18½ cents; 1874, 13 cents.

The first statistics comparing coal and fuel oil on the great Cunard liner, the Mauretania, were presented at an Oil Congress, held in London, England, in 1912. It was shown that 5,000 tons of fuel would be saved in the round trip from Liverpool to New York, through use of fuel oil and the force of stokers reduced from 300 to 30.

It is recognized that early quotations for crude oil are considerably obscured. According to the Derrick Handbook of Petroleum average crude oil prices from 1859 were as follows: 1859, $20 a barrel; 1860, $9.60; 1861, 52 cents; 1862, $1.05; 1863, $3.15; 1864, $8.15; 1865, $6.59; 1866, $3.75; 1867, $2.40; 1868, $3.62½; 1869, $5.60; 1870, $3.90; 1871, $4.40; 1872, $3.75; 1873, $1.80; 1874, $1.15.





Living conditions changed in the old days with the price of crude. Oil at from $5 to $20 a barrel permitted many luxuries not obtainable from two-bit crude

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

THE OIL BANK OF AMERICA
. . . In Tulsa, the Oil Capital of the World
Serving the Industry in all its branches—Producing, Refining, and Marketing—the National Bank of Tulsa offers ample credit for the furthering of all sound and legitimate petroleum activities. . .
The resources and the facilities of this bank are available to those who meet its reasonable requirements, whether their business be large or small.
E. I. Hanlon Chairman
A. E. Bradshaw President
NATIONAL BANK OF TULSA
TULSA OKLA.
Capital and Surplus $8,000,000 Resources $45,000,000
Member Federal Reserve System
TULSA - 1893
TULSA - 1934

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

View of section of wooden pipe line dug up at Marietta, Ohio

WELLS DRILLED FOR GAS AND PRODUCT UTILIZED MANY YEARS BEFORE DRAKE DRILLED HIS OIL WELL

NATURAL GAS—ERA NUMBER 1

Few histories are as unusual as that of natural gas, and whether its name be derived from ghost or from chaos, as variously asserted, it hid the secret of its light, warmth and power for more than 2,000 years at Karamanias, Slo-Tchouch and Baku, and did not yield its benefits until a century after the invention of artificial gas. Strangely enough, the first real achievement of natural gas was to lead Dr. John Clayton, a Yorkshire minister, to experiments between 1660 and 1670 and the invention of coal gas. Doctor Clayton related the gas spring at Wigan to the presence of coal there, but he did not make practical use of the gas he produced by heating the coal in a closed vessel. Jean Tardin, in 1618, had published an investigation of a burning gas well near Grenoble, France, but nearly two centuries were to elapse before investigators in England and France would indicate almost simultaneously the utility of gas on a large scale.

While natural gas was being wasted in the Appalachian and nearby fields, artificial gas was lighting streets and homes, cooking food, and operating internal combustion engines. While natural gas run to the steel mills was priced on a basis of iron and steel production, artificial gas was metered carefully and sold on a cubic foot basis. The natural gas industry did not begin to use the tools provided by the artificial gas industry until 1870, and their use did not become general until the beginning of the present century.

Earliest References

Probably the earliest reference to the occurrence of natural gas in the United States is that in connection with the visit of George Washington in 1775, to Kanawha Valley, now in West Virginia, where he found "a burning spring." Other gas finds which antedate the famous wells at Fredonia, N. Y., were the following:

In 1815, Capt. James Wilson, proprietor of Clendenen block house on the bank of the great Kanawha River in what is now Charleston, W. Va., drilled for salt water near the block house and at 500 feet he reached a gas sand. The tools were blown out of the hole and the gas became ignited. Captain Wilson was able to plug the well and abandoned it as worthless.

Dr. S. P. Hildreth, of Marietta, Ohio, wrote in 1819 that in boring (sic) salt wells along the Little Muskingum River, one well was "subject to such tremendous explosions of gas, as to force out all the water and afford nothing but gas for several days so that they could make little or no salt." The U. S. Geological Survey for 1885 refers to the action of natural gas throwing brine from wells drilled by David and Joseph Ruffner in 1807-08, in the Kanawha Valley, and later writings mention the drilling of a well in 1820, within the present limits of Pittsburgh, with disastrous results to the operators of a salt works. Gas from the well is said to have ignited and destroyed the brine plant, and the operators were glad when the hole was plugged and abandoned.

Fredonia Gas

The first well put down in the United States for the express purpose of obtaining natural gas was that at Fredonia, Chautauqua County, New York, in 1821. A natural gas spring on the Canadaway Creek bank was excavated to a depth of 27 feet and covered with a tin roof of conical form and from the apex of which a wooden pipe led to the building where the gas was used. This well supplied 30 burners and the light from each burner was regarded as equal to that of "two good candles." In 1825, William A. Hart replaced the wooden pipe with three-quarter inch lead pipe and put in a small copper gasometer. The well was deepened to 70 feet and was the only "commercial producer" until 1859 in Fredonia although a second well had been sunk in 1850. In 1859 the second well was converted into a shaft 30 feet deep, 6 feet in diameter at the top and 14 feet at the bottom. Two vertical borings were made at the bottom of this shaft, one 100 feet deep, and the other 150 feet deep. The new well raised Fredonia's gas production from 176 feet a day to 4,500 feet a day. In 1871 the third Fredonia well was drilled to a depth of 1,200 feet, and in the year 1885 the total yield of the three wells was 6,000,000 feet. Although a company was formed to carry out these improvements in 1858, it was not until 1865 that the first natural gas corporation, the Fredonia Gas Light & Water Works Co., was organized.

In 1823, John Klingensmith, who was drilling for brine on Brush Creek, 4 miles from Greenburg, Pa., struck gas and the fire which resulted destroyed his cabin. Five years later Judge Campbell, of Westfield, N. Y., made a contract with the Government to supply gas from springs nearby on Lake Erie to the Barcelona Harbor lighthouse. A fish barrel was used as a gasometer sealed over the spring, and a pipe line made of pine logs was run half a mile to the base of the lighthouse. The gas was conveyed to the summit through a lead pipe where it supplied 144 burners for 26 years.

Less fortunate was Walter Smith, of Dunkirk, N. Y., who got a contract to supply natural gas to the lighthouse there. Mr. Smith laid 2½ miles of half-inch pipe from the Matteson gas spring at Fredonia, but due to the size of the pipe no flow was obtained and the project was abandoned. In 1838 Daniel Foster, drilling near Findlay, Ohio, struck gas and turned it to practical use by inverting a sugar kettle over the gas stream and conducting it into his home through a wooden pipe. He made a burner by drilling holes in a gun barrel. Two years later, John Criswell, while drilling for salt water near Centerville, Butler County, Pennsylvania, got gas at 700 feet and used it under his kettles to evaporate brine.

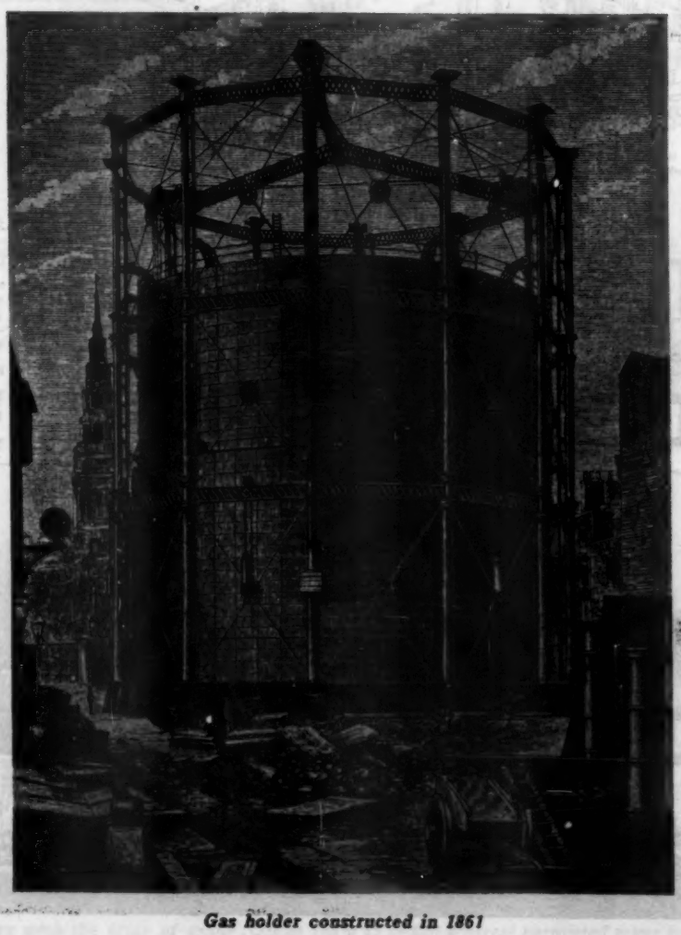
The Separator

The great grand father of oil and gas separators was probably that hogshead utilized in 1841 by William Thompkins to separate the gas he piped to his furnaces from the salt water evaporated in them. The salt water was lifted by the gas and poured into a reservoir under the hogshead, while the gas was piped out overhead. This was in Kanawha Valley, West Virginia. In 1843 a well drilled near that of Thompkins' came in with gas at a depth of 1,000 feet and proved to be the first "roarer," sending a column of water 150 feet into the air. In 1847, natural gas was utilized to a large extent for lighting in Findlay, Ohio.

While gas made by distilling coal or wood was used as early as 1803 for lighting in Richmond, Va., and artificial gas companies had been organized in Baltimore, 1816, in Boston, 1822, and in New York, 1823, useful consumption of gas, natural or artificial, was negligible until the period between 1865 and 1875. In 1879, came the invention, Edison's electric light bulb, which threatened to wreck the gas industry as effectively as the first petroleum refineries sealed the end of the coal oil business.

Utilization

The gas industry was starving in the midst of plenty because the operators could think only in terms of candle-power, or could devise no means of stabilizing their output. Yet inventors from Lavoisier to Otto had pointed the way to the gas industry of today representing investments of billions of dollars. In 1870 the pressure, 200 pounds, from a gas well near Oil City, Pa., was used to



Gas holder constructed in 1861

run drilling and pumping engines. This was 47 years after Samuel Brown, at Croydon, England, designed an engine to work on the principle of creating a partial vacuum under a piston by the explosion of a gas-air mixture, with the atmospheric pressure then producing the working stroke. These engines were in regular service in 1832 in several English cities. In 1826 a road vehicle was operated by one of these engines, and in the following year, a large boat. An improved free piston gas engine was exhibited in Paris in 1867 by Otto & Langen, the explosive charge of gas and air being fired electrically under the heavy piston when it reached its lowest position. A flywheel was used. Lenoir introduced the horizontal double acting type gas engine in 1860, and in 1862 Beau de Rochas, in Paris, pointed out the essential requirements of an internal combustion engine, and described the sequence of operation which later became known as the Otto cycle. In 1876 Otto embodied Rochas' suggestions in an engine operating on gas.

Advance Slow

From Lavoisier in 1781, who invented the gasometer to replace bladders, Crossley in 1825, who invented the gas regulator, and Clegg in 1815 or Malam in 1817, who invented gas meters, there was little advance until the approach of the present century. Gas was sold at so much per year per burner, and in Fredonia the annual cost was $1.50 for each burner. Where artificial gas was priced on a basis of consumption, a stop watch measured the time the valve remained open, or the meters used were of a wet type of questionable veracity. Natural gas wells were leased for $100 a year, and the output sold on a basis of the cost of coal thereby displaced or less. In subsequent periods under this section come the developments which multiplied the problems of the natural gas industry and the methods by which they were solved. During the period under discussion here, gas manufactured from coal was not priced sufficiently low for general use, and did not become so until after 1895. Natural gas was practically given away in the areas where it was produced and many years were to pass before long distance transmission would be considered.

The first use of natural gas in the oil fields was not encouraging. This was on Oil Creek and at Petroleum Center in 1862. Gas lines led to collecting barrels and lines from these to boilers, and often flames would run back in the line wrecking the apparatuses and firing the wells.

In 1872 gas from the Newton well, 5 miles northeast of Titusville, Pa., was conveyed to the town through a 2-inch cast iron pipe, and this pipe was later replaced with a 3¼-inch line to supply 250 firms and private homes with light and heat. The Newton well came in that year at a depth of 786 feet and produced a flow calculated at 500,000 feet a day, the pressure being recorded at 350 pounds. It is also recorded that the flow increased steadily until it reached 4,000,000 feet a day. Oil City in 1867 piped gas, primarily for use as an illuminant, but, the files of the Oil City Derrick show, this early project came to an end because of uncertain pressures at the well, and artificial gas was used to light the homes in the greatest oil and gas area of the time.

Industrial Use

Natural gas discovered in the vicinity of East Liverpool, Ohio, in 1860, at depths ranging from 400 feet to 600 feet, was turned to industrial use in the pottery of Homer Laughlin 13 years later. The first reference to the use of natural gas for industrial purposes is in 1868, when Jarecki Manufacturing Co., still a leader in the oil supply business, began to use natural gas in its plant at Erie, Pa. The Jarecki well was 600 feet deep. In 1874 Rawle, Noble & Co. attempted to introduce gas directly from the wells of the Erie district to blast burnaces under its own pressure of 25 pounds through a three-eighths inch pipe, without success.

When the famous Fairview (Pa.) well was struck in June of 1872, at a depth of 1,335 feet, a pipe line was laid 7 miles to Fairview, Petrolia, Karns City, and Argyle, where it was attached to 40 pumping and drilling wells, 8 pump stations, 200 gas burners and 40 cook stoves. A safety, or waste valve at the well had to be provided to take care of the excess pressure on the 3¼-inch gas main.

The first gas used in iron making was from the Leechburg well in 1873. The well was brought in at 1,200 feet on the south side of Kiskiminetas River, Armstrong County, Pennsylvania, in 1871, and in April of 1873 Rogers & Burchfield bought the well and piped the gas across the river to work on the north bank. A cylindrical boiler was used to separate the brine from the gas.

The discovery that natural gasoline could be produced from natural gas by compression is credited to Edwin C. Bell in 1873. Mr. Bell collected "casinghead" from the gas line to a 20-horsepower boiler on the high pressure side of the regulator. The gas well was owned by Milton Stewart, of Titusville, and was located on upper Benninghoff Run.

> ***In 1864, Prof. Benjamin Silliman, Jr., of New Haven, Conn., wrote: "The pretensions of diviners are worthless. The art of finding fountains or minerals by a peculiar twig is a cheat upon those who practice it, an offense to reason and common sense, an art abhorrent to the laws of nature and deserves universal reprobation."***

Moving Westward

Passing from New York, West Virginia, Pennsylvania and Ohio gas fields, records show that in 1860 gas was discovered in Wyandotte County, Kansas. In 1872 gas was found in wells drilled at Kansas City, Mo. As early as 1854 gas wells were brought in at Stockton, Calif., but natural gas was not utilized until much later, 1902. In 1874 natural gas was discovered at Mattoon, Ill., in water wells.

A wooden, natural gas pipe line was laid in Marietta, Ohio, in 1857. The wooden pipe extended a distance of about 2½ miles, chiefly through the business section at the Point in Marietta. The ordinance providing for the laying of this line was passed by the Marietta council August 30, 1856. It ordained that E. Gwynn, his associates, and successors, to be organized as "A Gas Light Company," shall for the term of 20 years, from the passage of this ordinance, have the exclusive privilege of using streets, lanes, alleys, and public grounds of said city, for the purpose of laying down pipes for the conveyance of gas in and through said city, for the use of said city and its inhabitants.

It provided also, "that for the period of 10 years from the passage of this ordinance; the price for gas furnished to said city, and its inhabitants, by said guarantees, shall not exceed $4 per 1,000 cubic feet, and that the gas so furnished shall be of the best quality."

Present-day pipe line contractors who are given but a few months to construct hundreds of miles of large size pipe lines might be interested in the fact that the city council of Marietta allowed the gas company four years in which to build 2 miles of line, stipulating that at least 1 mile was to be laid and placed in operation within two years. Provision relating to this construction states:

"Provided, also, that said grantees shall cause 2 miles of pipe to be laid down within four years, and at least 1 mile of pipe to be laid down, and the contemplated gas works to be erected and put in operation within two years from the passage of this ordinance, and shall by the first day of October next, deposit with the city clerk of said city a bond of $1,000 to be forfeited if the said contemplated gas works shall not be in operation within two years from the passage of this ordinance."

This wooden pipe was constructed of selected white pine. Logs were cut into lengths of from 2 to 8 feet, depending on the soundness of the timber, and sorted to insure perfect wood. They then were turned to an outside diameter of 6 inches and bored to 2 inches inside diameter. Each joint was bored on the bell end to a diameter of 4 inches, and about 4 inches in, and a band of iron shrunk around the belled end. The other end was turned to fit the bell. They were then tarred inside and out.

The joints were made by dipping the end in hot tar and driving it into the bell. A block of hard wood about 12 inches in diameter and 3 feet long was hung by a rope from a horse above the ditch. This served as a battering ram and two men could drive a joint home with 9 or 10 blows.

As experience was gained, as high as 240 joints were made in a day. Very few leaks were found in the line, but such as did occur were repaired by wrapping the pipe with many thicknesses of burlap soaked in tar and the ditch filled in to hold it in place.

The Tarr farm along Oil Creek

Burning well

Wooden Pipe Lines

In 1871, the Hyde Park Gas Co., Chicago, Ill., laid 3, 4, and 6-inch wooden mains, using red lead putty to seal the joints. In 1872 a natural gas pipe line made of white pine was laid 25 miles from West Bloomfield, N. Y., to Rochester. The line had an inside diameter of 8 inches and an outside diameter of 12½ inches. Bells were made by enlarging the inside diameter to 10 inches for a depth of 4 inches, and the spigot was correspondingly decreased in the outside diameter. The lengths were tarred, and iron gates were installed at intervals. The first test of the line pulled many of the joints apart and split a number of the lengths. It was found that the line could carry only 1 pound of pressure without unwarranted loss and so was abandoned shortly after completion.

Other Dates

Other dates of interest during this first period are the following: In 1862, Prof. T. S. C. Lowe suggested the use of gas in a balloon to observe Confederate batteries at Fair Oaks, Va. In 1864, Doctor Rowell applied gas lift to crude oil production. The cost of the gas wells, 600 feet deep, was $6,000 to $6,500. In 1865 first mention is recorded of appeals to conserve gas to prolong life of crude oil wells. In 1867 Westfield, N. Y., built its natural gas works. In 1870 a gas well near Rochester, N. Y., came in for 400,000 feet a day. In 1870 the Erie, Pa., water works used gas to fire boilers, and refiners used gas under their crude stills. In 1871 Buffalo, N. Y., drilled a gas well for city use. In 1871, Painesville, Ohio, discovered natural gas and in the following year gas was used for light and heat in homes. In 1885, it is recorded, gas was used near McCoy's Station, Pa., in the manufacture of lampblack.

If you do not use or specify Tru-Lay Preformed Rotary Lines it's probably because you do not know that Tru-Lay costs more!

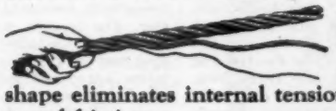
● It is a fact that Tru-Lay Preformed Rotary Lines *do* cost more than lines *not* preformed. *But* you will pay less for Tru-Lay service than what you pay for *non*-preformed rope service.

It is also a fact that the many users who have checked Tru-Lay service against that of *non*-preformed rotary lines—even including our own "Crescent"—have proved to their own satisfaction that, *in the long run*, Tru-Lay costs far less. They have found that the longer life of Tru-Lay more than justifies its higher initial cost.

The ever-increasing sales of Tru-Lay as compared with "Crescent" and other *non*-preformed rotary lines furnish convincing proof that Tru-Lay gives greater dollar-for-dollar value—and that its *ultimate final* cost is *lower*.

• • •

Here are a few outstanding Tru-Lay advantages:



Preforming the wires and strands to their helical shape eliminates internal tension and reduces internal friction.

"High-stranding" and "low-stranding" are eliminated. Each strand carries its own share of the load.

Tru-Lay preformed wires and strands lie relaxed—they are not cranky—therefore resist kinking.

Tru-Lay requires no seizing, because of the absence of internal tension.

Where splicing is necessary, the strands fit into position between adjacent strands, thus making the job easier and quicker.

Costly shutdowns for repairs and replacements are reduced to a minimum, because of Tru-Lay's much longer service.

• • •

Tru-Lay Preformed Rotary Lines are made in all necessary sizes, grades, constructions and lays. Our engineers are ready to help you determine your requirements. Write for detailed information.

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FROM AN ACTUAL PHOTO

TRU·LAY *Preformed** Rotary Lines

*PREFORMING IS A PATENTED MANUFACTURING PROCESS APPLICABLE TO ANY TYPE, GRADE, CONSTRUCTION AND LAY OF WIRE ROPE—WITH THE RESULT OF GREATLY INCREASING ITS SERVICE

CARTER . . BARNSDALL . . DONNELL . . SHULER . . VAN DYKE . . PAYNE . . ROCKEFELLER . . BAYNE . . ROGERS . . ARCHBOLD . . SEEP . . IRISH
JENNINGS . . EVANS . . VANDERGRIFT . . SHANNON . . SIMPSON . . CHAMBERS . . SMITHMAN . . EMERY . . MATSON . . FERTIG . . KIRK . . GALEY

PERSONALITIES

John J. Carter, founder and first president of the Carter Oil Co., learned and practiced the tailoring trade before he went into the oil business as a wildcatter around Pithole and Petroleum Center in the late sixties.

T. N. Barnsdall, founder of the Barnsdall Oil Co., drilled his first well near Titusville, Pa., at the age of 16 years. His father, William Barnsdall, completed the first oil well after the Drake discovery well, in 1860.

J. C. Donnell, many years president of the Ohio Oil Co., was initiated into the oil business in 1872 in Crawford County, Pennsylvania, with a job hauling oil to a refinery in Titusville.

Isaac Shuler, later a Mid-Continent and Michigan operator, started in 1874 at the age of 9 helping to recover b.s. from oil tanks, load it into barrels and haul it to a Tidioute, Pa., refinery. He was paid 2½ cents per barrel.

John W. Van Dyke, chairman of the board of the Atlantic Refining Co., was a rig builder and later a drilling contractor in Pennsylvania in the late sixties.

Calvin N. Payne, who rose to be head of all Standard Oil Co.'s gas interests, drilled his first well near Tarentum, Pa., in 1864 at the age of 16. It was a 217-foot dry hole.

John D. Rockefeller, at the age of 7, earned his first money, 2 "shillings." (25 cents in New York State), clearing a neighbor's yard of stones. His first business venture was in raising a brood of turkey chicks to maturity and selling them. By this time he had grown to the advanced age of 8 years. In September, 1855, at 16 years of age, he became a junior bookkeeper in a Cleveland, Ohio, commission house. He entered the oil business as a member of the firm of Clark & Andrews, refiners, in 1862, in Cleveland, at the age of 23 years.

William Rockefeller started his business career as a bookkeeper in the employ of a Cleveland miller named Quinn in 1858. Later he was a member of the firm of Hughes & Rockefeller, commission merchants. In 1866, with John D. Rockefeller and Samuel Andrews, the firm of William Rockefeller & Co. was organized to market oil products. The firm's headquarters were in New York, in charge of William Rockefeller.

S. G. Bayne, founder of a firm which eventually became the National Supply Co., reached the oil country about 1870, locating temporarily at Titusville. He paid $300 for the old Sugar House well, a stone's throw away from the Drake well, and got into the oil business. His first employment was as an apprentice to a grain importing firm in Belfast, Ireland, about 1864.

Henry H. Rogers, later a director and officer of the Standard Oil Co. of New Jersey, went to Titusville in 1861, at the age of 21. Gurley Hinkley taught him the practical side of refining oil in a little plant established by Mr. Rogers and Charles P. Ellis in Titusville soon after his arrival. His first job had been as a clerk in his father's store at Fair Haven, Mass., and then he tried railroading, which was not to his liking.

John D. Archbold, who became president of the Standard Oil Co. of New Jersey, started life as a clerk in a country store in Salem, Ohio. He went to Titusville at the age of about 20 years entered the employ of William H. Abbott, oil refiner, and later became a partner in the firm of William H. Abbott & Co.

Joseph Seep, who for many years headed the Standard Oil Co.'s crude oil purchasing department, learned and followed the cigarmaking trade as a boy and a young man and then was a clerk in the employ of a grain and hemp dealer. He went to Titusville in 1869 and with his old employer, Jabez A. Bostwick, went into the business of buying and selling crude petroleum.

William M. Irish, a pioneer in the refining of oil, started as a clerk in the customs house in New Bedford, Mass., in 1853, continuing until 1861 when he helped organize the Fair Haven Rock Oil Co. and entered the refining business in Fair Haven, Mass. His first plant had a capacity of 75 bbls. of crude per day.

Richard Jennings, father of Edward H., Richard M., and John G. Jennings, later prominent in oil, left the mining business at the age of about 42 in Queenstown, Pa., purchasing fractional interests in oil ventures. He got nothing out of it but experience, but he met with success in the Parker district in 1869 and became ranked among the big ones in oil production.

Edward H. Jennings, as soon as he left school joined his father in the late sixties and was soon placed in charge of the latter's oil properties. Upon his father's death the three sons, known among their intimates as Ed, Dick and John, organized the firm of E. H. Jennings & Brothers, oil producers.

Joseph H. Evans, president of the Devonian Oil Co., hauled oil in barrels from Shamburg to Pithole in 1867, which was his baptism in oil.

Jacob Jay Vandergrift started as a cabin boy on the river steamer, Bridgewater, at Pittsburgh about 1843. When oil was discovered in the Drake well he entered the shipping business with Daniel Bushnell between the oil region and Pittsburgh.

P. M. (Mark) Shannon, codiscoverer of the Salt Creek Pool in Wyoming, and a prominent producer and wildcatter, started as a salesman for a Pittsburgh mercantile house in 1864. He entered the oil region in Parkers Landing where he was associated with Richard Jennings in "The Guerrilla Well."

Thomas B. Simpson, Pennsylvania oil producer, came from an Iowa farm to Oil City at the age of 19 and was employed as a clerk by Lockhart & Frew, one of the largest of oil region refiners.

Wesley Chambers, who with Capt. J. T. Jones, later organized the Bradford Oil Co., worked on the home farm and taught school in the winter before going to Tidioute and Titusville, where he transported oil with teams and barges in 1860-1861.

John B. Smithman, who organized the first workable clearing house system in the Oil City Exchange, and also became a prominent oil operator, started as an oil buyer in a small way for John Munhall & Co. in 1864.

Lewis Emery, Jr., producer and refiner and one of the organizers of the Pure Oil Co., and United States Pipe Line Co., started life as a school teacher in Hillsdale, Mich. His first oil venture at Pioneer, Pa., in 1865 was successful.

Myron Matson, organizer of the Matson Oil Co. in the Osage Nation, Oklahoma, started his career as a farm-hand near Cuba, N. Y. His first work in the oil country was pick and shovel labor and later he became a teamster at Tidioute in 1870.

John Fertig, head of a family of pioneer operators in the Pennsylvania Field, was first a school teacher. He began his oil career in 1859 by securing a lease on the upper Funk farm starting his first well with a springpole outfit in 1860, completing a 500-bbl. well.

David Kirk, president of the American Oil Development Co., and one of the organizers of the Pure Oil Co., when a little boy worked in a cotton mill. Later he learned the carpentering trade. He drilled his first well in 1860 at Smith's Ferry, Pa. He started Kirk's Oil Yard in 1862 for the pumping, storing and shipping of petroleum, the first of its kind.

John H. Galey, of the noted firm of Guffey & Galey, started his oil career with the famous Maple Shade gusher at Pleasantville, Pa.

Henry F. James, prominent early producer and pipe liner, was a whaler before entering the oil business in 1861 in Venango County, Pennsylvania.

John McKeown, who amassed a fortune of $10,000,000 in oil production in the Pennsylvania fields and was the largest individual oil producer in the eighties, started life working on the docks at Newry, Ireland. He went to Petroleum Center, Pa., in 1866 with what remained of $25 he had borrowed to make the trip from New York. He first engaged as a day laborer, then as a driller, contractor and finally producer. He hated to owe anyone and throughout his business life he paid cash for everything that could be conveniently paid for when ordered or upon delivery.

Lewis E. Mallory, of Treat & Mallory and Mallory & Son, producers, and one of the organizers of the United Fuel Supply Co., started as a tool dresser for his father at the mouth of Bull Run on Oil Creek, in 1864. He drilled the first big well in the Lima Field in Ohio.

Cyrus D. Angell, who established the "Belt Theory" or "45 degree trend" which was that the oil-producing sand rocks in the Venango Field, had a northeast-southwest trend with a dip in the formation as it went southwestward, and who became a big operator and dealer in oil properties, started in the oil business in 1867, having sold out his mercantile interests and invested in prospective oil lands.

Jesse A. Heydrick gave to the oil country the first oil and gas lease that stood the test in every court in Pennsylvania, Ohio, and Indiana. It was called the Heydrick No. 4.

Jesse R. Leonard, one of the organizers and first presidents of the Ohio Oil Co. and veteran natural gas man, went to Pithole, Pa., at the age of 17. His first work was on a drilling well on Two Mile Run above Franklin in 1865. By 1871 he had gone into the oil-producing business.

John Bird, prominent eastern producer and father of Jay W. Bird of Hanley & Bird, oil and gas producers in numerous fields, started on Oil Creek as a lease worker and later teamster.

David Bovaird, founder of a family of oil well tool makers and supply men, was originally a coal miner, but started in the oil business in Venango County, Pennsylvania, in the sixties as a teaming contractor.

Patrick C. Boyle, oil country publisher, as a boy worked in coal mines. He entered the oil country in 1864 after serving a three-year enlistment in the Federal army and started as a lease worker, and later a pipe line worker in the Venango district.

S. R. Dresser, founder of the S. R. Dresser Manufacturing Co., maker of pipe line couplings, also a pioneer sucker rod and well packer manufacturer, went to West Virginia in 1865 at the age of 13, and at the first sign of an oil excitement he was on the ground and notwithstanding his boyishness got himself a job as a lease worker.

Lewis E. (Uncle Dudley) Hamsher, partner of Lewis Emery, Jr., in many of the latter's oil interests, started in Venango "working around wells" in the late sixties. He became a producer in 1872 in Clarion County.

Judson E. Haskell, prominent early day and middle period operator, father of Fred Haskell, manager of the Empire Pipe Lines, and father-in-law of Herbert R. Straight, vice president and general manager of the Empire Oil & Refining Co., started as a clerk with Vandergrift & Forman in 1865, later going into pipe lining and still later becoming the Standard Oil Co.'s oil buyer under J. A. Bostwick.

Capt. Joseph T. Jones, founder and later sole owner of the Bradford Oil Co., and the largest individual producer in the Bradford Field at one time; later a railroad magnate and electric traction pioneer, arrived on Oil Creek in 1865 at the age of 23, and promoted and drilled 13 dry holes before he got a well which started him on the road to fortune.

H. L. McMullen, of the producing firm of Whitney & McMullen, learned the blacksmith's trade at Warren, Pa., and started as tool dresser in the Warren County fields in the early seventies.

William Robertson, pioneer oil country blacksmith and tool maker in the Pithole, Petrolia and Bradford Fields, was apprenticed to a blacksmith in Perthshire, Scotland. He arrived at Pithole in 1865, a trained and experienced workman and business man and became noted for the quality of his products.

J. L. Seyfang, one of the founders of Bovaird & Seyfang, learned the machinist's trade in Buffalo, but started in the oil country as a well worker in Petroleum Center in 1868.

R. J. Straight, extensive oil producer in the Bradford Field from 1876 on, arrived on Oil Creek in the sixties and landed a job. Later he was in charge of the famous Noble well on the Farrel farm which was the largest well of its time, producing altogether 442,000 bbls. of oil. He was the father of H. R. Straight, of the Empire Oil & Refining Co.

John P. Zane, veteran oil producer and publicist, was bound out to a New Jersey harness maker when a small boy. He never attended school a day in his

JAMES . . McKEOWN . . MALLORY . . ANGELL . . HEYDRICK . . LEONARD . . BIRD . . BOVAIRD . . BOYLE . . DRESSER . . HAMSHER . . HASKELL
JONES . . McMULLEN . . ROBERTSON . . SEYFANG . . STRAIGHT . . ZANE . . WEAVER . . COLLINS . . GEARY . . MUNN . . WILSON . . FARRAR
PRATT . . DEAN . . FLAGLER . . O'DAY . . SCHEIDE . . MILLER . . LOCKHART . . EATON . . BRUNDRED . . FUNK . . McKINNEY . . ROBERTS . . JARECKI

life, but became a successful business man and a noted public speaker and writer. He was one of the early arrivals in Titusville after the Drake discovery well.

W. R. (Riley) Weaver, partner of Lewis Emery, Jr., and L. E. Hamsher, oil producers and oil country hardware dealers, began life as a school teacher. He joined Mr. Emery in Titusville in 1870 and later was made a partner.

Charles P. Collins, one of the founders of the Devonian Oil Co. and a widely known producer, started in Shamburg, Venango County, Pennsylvania, in the late sixties, drilling shallow wells with springpole tools. Later he took up tool dressing on standard cable work in the Red Hot district, became a driller, and then a contractor. In 1872 he joined the ranks of producers.

Michael Geary, pioneer tank and boiler manufacturer, went to war in 1861 at the age of 15, and after the war started business life with the Erie City Iron Works, beginning at the bottom and learning the business thoroughly. In 1871 he arrived in the oil country to stay, locating first at Titusville as foreman for Gibbs, Sterrett & Co., at the age of 27 years. Later he developed many interests including the presidency of the Snow Pump Works in Buffalo and of the Oil City Boiler Works.

William Barnsdall, Sr., the world's second oil producer and first oil refiner, and father of three well known sons, known to their friends as The., Bill and Bide, otherwise T. N., William, Jr., and N. B. Barnsdall, learned the shoemaker trade in England and was following his trade in Titusville when the Drake well came in.

S. W. Munn, who became a well fisher of national reputation as well as an oil producer, worked on a well in Breckenridge County, Kentucky, in 1862, with his father and brother when he was 12 years old. The well was "kicked down" with a springpole and was dry.

Henry M. Wilson, of Bayne & Wilson, Bayne, Wilson & Pratt, and one of the founders of the National Supply Co., started in the oil country soon after the Civil War as an employe of the McCalmont Oil Co. Previous to the opening of the Bullion Field he had an interest in and drilled 17 dry holes. Then he sold for a small sum a 1-acre lease and a partly drilled well to Thomas Phillips because all around it were dry holes. The well came in for 1,700 bbls. a day. His luck as an oil operator continued this way until he became disgusted and went into the supply business where he was highly successful.

Charles W. Pratt, another of the founders of the National Supply Co., landed in Oil City in 1864, with a healthy body, a world of confidence and 80 cents. He got a job at the Humboldt refinery on Cherry Run, above Rouseville. At 19 he formed the Shenango Valley Oil Co. and drilled a test on a 600-acre lease. It was very dry and all went broke. He went to Pithole and labored in the field again but at 20 he organized another company, Pratt, Lawrie & Co., and "struck oil."

C. M. Farrar and John Trefts, a couple of youngsters with little money, a lot of brains and much intestinal fortitude, started making engines in a little shop on Perry Street in Buffalo back in the sixties, and the oil country was a fine market for their product. They added good boilers to their line, hooked up with a real salesman and publicity man, S. G. Bayne, and their names became a household word in the oil regions of the world.

I. E. (Farmer) Dean, oil producer, public speaker and advocate of the rights of man, started contracting in the Canadian oil fields in 1864. He emigrated to Butler County, Pennsylvania, in 1873 and was a part owner of the great "Sweepstakes" and "Red Cloud" wells, among the best in the field at the time.

Henry M. Flagler, Standard Oil official and director, started to work at 14 years of age as a clerk in a country store in Orleans County, New York. This was in 1844. He saved every cent possible until he had money enough to move to Saginaw, Mich., and go into business. He conducted a salt works in that city and then moved to Cleveland where he entered the oil refining business, finally joining the firm of Rockefeller, Andrews & Flagler.

Daniel O'Day, most noted of pipe line men, worked on a Cattaraugus County, New York, farm until he was 16. Then he went to Buffalo, N. Y., and obtained a job in the freight yards of a railroad. He was transferred to the warehouse and moved up into the transportation department. He arrived in the oil regions in 1865 and his natural talent as a transportation man gave him the opportunity of showing the oil industry how it could get its oil moved. When the pipe lines began growing in number Joseph Seep induced Mr. O'Day to join with Bostwick & Co. and his real career began..

Charles Pratt, another veteran of the old school of Standard Oil big men, was working on a farm in Massachusetts in 1840 at the age of 10. Then he learned the machinist trade; later becoming a clerk with an oils and paints firm. In 1853 the firm of Raynolds, Devoe & Pratt was formed. In 1867 he went into the business of oil refining at Greenpoint, Long Island.

William T. Scheide, veteran pipe line official, was a railroad telegraph operator, becoming superintendent of telegraph for the Pittsburgh & Connellsville Railroad. He studied civil engineering and came to the oil country in 1868 and joined Pierce & Neyhart, shippers of oil.

Gen. Charles Miller, president of the Galena Oil Co., and Joseph C. Sibley, president of the Signal Oil Co., who later organized the Galena-Signal Oil Co., large oil refiners, started life humbly. Mr. Miller as a grocery clerk and Mr. Sibley as a farm boy and later a country school teacher.

Charles Lockhart, one of the founders of the Atlantic Refining Co., started as a clerk for James McCully in Pittsburgh, and later became a partner. His first deal in oil was in 1852, the purchase of 3 bbls. of crude from a salt well in Westmoreland County, Pennsylvania. Later he left the firm of McCully & Co. and went into the business of buying and selling oil. When the Drake well was drilled he became a partner in Phillips, Frew & Co., and started on his real oil career.

John Eaton, many years president of the Oil Well Supply Co., started in the oil well supply business in 1861, and has been called the father of the supply business. He was a clerk in the employ of Nason & Co., in New York when he decided to go into oil well supplies. He first went it alone and then the firm of Eaton & Cole was formed, later becoming Eaton, Cole & Burnham, and finally the Oil Well Supply Co., Ltd., a combination of several supply firms.

Capt. A. B. Funk of Titusville drilled the first flowing well, which was appropriately called the Fountain Well, on the McElhenny farm, a short distance north of what became Petroleum Center. It was drilled to 200 feet with springpole outfit and then with steam power to the third sand, at a total depth of 460 feet, with the top of the sand at 400 feet. The well flowed 300 bbls. per day initially.

B. F. Brundred went to Oil City in 1866 and was made chief clerk of the Empire Line in charge of all oil shipments. In 1877 he retired from transportation to go into the oil business in the Edenburg and the Bradford Fields. He built the Union refinery in Oil City in 1879, his entrance into the refining business, in which later he became a prominent figure.

J. L. and J. C. McKinney, of whom the former is still living at 92 years of age, were Warren County boys, who came into the Titusville area in the early sixties with a very little capital and immediately went into the oil business as operators. J. L. (Lew) McKinney arrived first and his initial venture was a dry hole, but other early ventures were successful. Later Lew and Curt McKinney became known as large operators before the elder brother reached the age of 30.

Col. E. A. L. Roberts of Roberts torpedo fame, who held a monopoly on the business of "shooting" oil wells, was a dentist who later became a manufacturer and dealer in dental supplies. He owned numerous patents relating to dentistry. In 1862 he worked out an invention designed to increase the flow of oil in a well by exploding a torpedo in the oil sand, and had it patented. He made up several torpedoes and took them to Titusville and after much persuasion he was given a chance to try out the invention in the "Widow's well" on Watson Flats. It was a great success.

H. Jarecki & Co. of Erie, Pa. (Petroleum Brass Works, eventually the Jarecki Manufacturing Co.) drilled two gas wells in Erie County, the first one finding gas at 1,200 feet in 1854.

Standing, left to right: George Rattan, Edwin C. Bell, Roxe Reisinger, B. F. McCracken, Lyman D. Rhodes, Samuel Fertig, Joshua McCracken. Sitting, left to right: Samuel B. Smith, who worked on Drake well (his father, Uncle Billy Smith was the driller); William Hoffman, Capt. William Hasson and J. J. McLaurin

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

EARLY CRUDE PRICES RANGED FROM A DIME TO $20, WITH HIGH AVERAGE

PRICES—ERA NUMBER 1

Considering crude oil price conditions and drilling and development costs covering the whole 75 years of the oil business, it appears that the early-day oil producer was the most fortunate of all those who have bored into the bowels of the earth in search of petroleum.

From the discovery of oil in northern Venango County, Pennsylvania, in the summer of 1859 until the end of the first 15-year segment of the industry's life, the oil producer received an average of $3.60 per barrel for his oil. The prices ranged from a dime to $20, but the average price was profitable.

The average prices for oil covering a year varied from $16 per barrel in 1859 to 49 cents per barrel in 1861, during which year the market fell to prices similar to those occasionally heard of in the East Texas Field 70 years later, when oil sold as low as 2½ cents per barrel in a bulk disposal of 50,000 bbls.

In the first 15 years of the oil industry 54,357,000 bbls. of oil was produced in the United States. This oil had a value of $195,766,000, or an average value of $3.60 per barrel. All the oil recorded was produced in Pennsylvania.

We can find no dependable record of production by months in the early days of the industry. All the production data are on an annual basis, together with total value and average value per barrel. The year 1859, as far as the oil industry is concerned, started on August 27, therefore had only 126 days. In figuring production for the first 15 years ending with December 31, 1873, we find that in 5,240 days the production of the United States was equal to about 22 days' petroleum requirements in 1934, as figured by the Federal Petroleum Administration. But it was too much for those days, because at the close of August, 1874, crude oil stocks had piled up to 2,932,444 bbls. or the equal of about three months' crude oil consumption in the closing months of the 15-year period, and had been steadily increasing through the years. At the end of January, 1870, crude oil stocks had reached a total of 340,154 bbls. In the opening month of 1871, 537,751 bbls.; 1872, 1,084,423 bbls.; 1873, 1,625,157 bbls. Stocks hit the 1,000,000-bbl. mark in June, 1872, and passed the 2,000,000-bbl. mark in February, 1874.

Production and Values

The accompanying table will show the total production by years, the value of the oil and the average value per barrel.

The sharp slump in 1873 prices was caused, in part at least, by the post-war panic, which started with the failure of the famous banking house of Jay Cooke and partners, followed by bank crashes all over the country, and a tumbling of prices of all commodities.

From 1859 until 1864 almost the entire yield of crude petroleum was from the Oil Creek Valley, in Venango County, Pennsylvania.

The production in 1859 is given as 2,000 bbls. In using this figure the ancient chroniclers must have included only the production of the Drake well, because, as a matter of record, Pittsburgh wharf authorities reported receipts of 7,037 bbls. delivered by boat to that port in that year, most of which came from salt wells at Tarentum. Therefore it is safe to say that about 8,500 bbls. of oil was brought to the surface in Pennsylvania in that year but in figuring crude oil production the only authentic records are those representing crude oil produced from oil wells. The production of oil from salt wells antedated the Drake discovery by years.

Wide Price Fluctuations

The crude oil market prices from the time of the Drake discovery until 1874 or 1875 cannot be given in exact figures. It has never been possible to give better than approximate figures on prices in those days. The best record in existence shows that the average price paid in January, 1860, was $19.25 per barrel, but prices fell steadily until at the close of the year the market had reached an average of $2.75 per barrel. In 1861, with the breaking out of the Civil War the market fell from an average of $1.37½ in January to 10 cents per barrel in the last three months of the year and the first month of 1862. Then it climbed steadily to $2.25 in December, 1862, and continued upward until July, 1864, when it reached a high of $14 per barrel, closing the year with an average price of $11 per barrel. At the close of 1865 it averaged $6.50 per barrel and then fell off until it reached $1.50 in March, 1867, closing the year with an average price of $1.87½.

The year 1868 was a better one for the producer, the price ranging from $1.70 to $5.45 per barrel, but in February, 1869, the market reached $7 per barrel, dropping off to an average of $5.12½ in the last month of that year.

Prices in 1870 fluctuated between $4.90 and $2.75 per barrel, the average for December having been $3.40. There was a sharp rise early in January, 1871, starting at $3.25 and ascending to $4.75. The top was reached in June at $5.25 per barrel, dropping to $4 in December, with an average for that month of $4.35.

Prices in 1872 fluctuated between a high of $4.12½ in June to $2.67½ in December, the average for December being $3.20.

Then came the panic year when crude oil fell from $2.75 to 82½ cents the first below-dollar price since 1861. At the close of August, 1874, or at the end of the first 15-year period the crude price averaged an even dollar per barrel.

Reported Production in Gallons

As said before, all the recorded production of crude oil came from Pennsylvania fields in the first 15 years of the industry. In the first year after the discovery near Titusville most of the drilling took place along the lowlands of Oil Creek, French Creek and the Allegheny River, but oil was also found at Tidioute, Warren County, and Henry's Bend, Franklin and Smith's Ferry in Venango County. In those early days oil production was reported in gallons. Thus, in 1860, Hamilton McClintock's well, 2 miles north of Oil City, was put on the pump and started off at 60 gallons per minute, and the Barnsdall, Mead, Rouse & Co. well near Titusville was reported to have produced 56,000 gallons of oil from February 1 to June 1, 1860. This latter mentioned oil sold for $16,800. Later when statistics on crude oil production were compiled these gallons were changed to barrels of 42 gallons each, for the sake of uniformity, this standard having been adopted in 1866. Most of the oil produced in the early years was delivered in boats by way of the Allegheny River to Pittsburgh, but some of it was sold to local and to Erie, Pa., refiners.

First Flowing Well

In 1861 the first flowing well was recorded. It was drilled by Capt. A. B. Funk on the McElhenny farm in Venango County, and was sent to the Third sand found at 400 feet. The Funk well flowed 300 bbls. per day, but was followed quickly by other flowing wells some of which were reported to have produced from 2,000 to 2,500 bbls. per day in their brief flush stages. These big wells oversupplied the market to such an extent that oil was sold as low as 5 cents per barrel at the well. Much oil was lost because of the ignorance of the primitive producer and driller of means of shutting in the wells.

The panic which swept the country with the announcement of war between the states fell heavily on the industry, but by the middle of June confidence was restored to some extent and field operations began to be pushed with renewed vigor.

First Pipe Line Tested

During 1862 and 1863 most of the successful operations were along Oil Creek, French Creek and the Allegheny River as far north as Tidioute. The wildcatter was at work even as far north as Bradford and also to the south along the river, but the tests were not drilled deep enough to reach the oil formations. It was in 1863 that the famous Noble & Delamater well was completed on the Farrel farm on Oil Creek. It started at 3,000 bbls. a day and became one of the largest producers in the history of the early Eastern Fields. It was late in 1862 that the first test of conveying oil in pipe lines was being made. The project was to ship oil from the Tarr farm to the Humboldt refinery at Plumer, Venango County. In 1864 field operations were extended to the Cherry Run district in Venango County, and the Rynd farm at Rouseville, one of the famous oil farms in eastern oil history, first came into prominence.

Collapse of Fake Oil Companies

The year 1865 witnessed the collapse of many speculative oil bubbles that were floated freely in all parts of the country, but the legitimate producing firms and companies carried on most successfully.

The Pithole Field was opened and the city of Pithole was started and grew to a town variously estimated as to its peak of population from 10,000 to 15,000.

Good wells were found at Church Run, Fosters and Cherry Run and a small well opened up the Parker's Landing district in Armstrong County. Many miles south in Greene County, the most southwesterly of Pennsylvania counties, oil was discovered along Dunkard's Creek.

A successful pipe line began conveying oil from Pithole to Miller Farm, in Venango County. A war tax of $1 per barrel on crude oil was a severe drain on oil producers.

The first well in the Pithole Field was located with the aid of a witch hazel twig by Thomas H. Brown. It was on the Thomas Holmden farm and produced 250 bbls. per day at first, the oil selling at $8 per barrel. The first river bed oil company was organized in 1865. It asked the State of Pennsylvania to grant it a lease on the Allegheny River bed in Warren and Venango Counties. Oil men strenuously objected and the State legislature refused the grant.

The Cherry Run & Oil Creek Railroad was given a franchise for a railroad from Oil City to the Storey farm on Oil Creek. The Atlantic & Great Western Railroad constructed a branch line into the oil fields. These railroads began to take part in the transportation of oil to distant markets. Steamers plied up and down the Allegheny River, carrying passengers and oil field supplies.

Influx of War Veterans

Many thousand veterans of the Civil War rushed into the oil country as soon as they were discharged from the service. Some of the most notable oil men in the later years of the industry were among these young soldiers who were merely job hunting when they reached the oil country. It was about this time that James Robinson and his brother William perfected their system of strapping and measuring tanks which system has been in use with some slight modifications ever since.

In October, 1865, the report was received that a well in Cumberland County, Kentucky, had come in flowing 2,000 bbls. per day. Oil was discovered in a well on Tionesta Creek in Forest County, 10 miles south of Sheffield, Pa. Clarion County joined the ranks of oil producing counties, so that at the close of the year it was known that oil existed in Warren, Forest, Clarion, Venango, Crawford, Armstrong and Greene Counties in Pennsylvania.

Big Well in West Virginia

Clarion County began to play a prominent part in the industry in 1866 and Forest County also stepped into the picture as a real oil territory. A big well was completed at Oil Rock, near Burning Springs, W. Va. The year marked the general introduction of railroads into the oil region and the increased shipments of oil by rail.

In 1867 the Dennis Run and Triumph Hill Pools near Tidioute, Warren County, and the Scrubgrass Pool in Venango County, and Shamburg Pool in Clarion County were opened. A report on the

Year—	Quantity produced (bbls.)	Value of oil	Average value per barrel
1859	2,000	$32,000	$16.00
1860	500,000	4,800,000	9.60
1861	2,114,000	1,036,000	.49
1862	3,057,000	3,210,000	1.05
1863	2,611,000	8,226,000	3.15
1864	2,116,000	20,807,000	9.87
1865	2,498,000	16,460,000	6.59
1866	3,598,000	13,455,000	3.74
1867	3,347,000	8,067,000	2.41
1868	3,646,000	13,217,000	3.63
1869	4,215,000	23,730,000	5 63
1870	5,261,000	20,504,000	3.90
1871	5,205,000	22,591,000	4.34
1872	6,293,000	21,441,000	3.41
1873	9,894,000	18,100,000	1.83
Total	54,357,000	$195,766,000	$3.60

ROCKY MOUNTAIN: Montana, Wyoming, Colorado, New Mexico. MID-CONTINENT: Kansas, Oklahoma, Texas. GULF COAST: Texas, Louisiana, Alabama. NORTH CENTRAL: Michigan. PACIFIC COAST: California. APPALACHIAN: New York, Pennsylvania. CANADA: Alberta, Saskatchewan, Quebec. MEXICO: Tuxpam Area, Isthmus of Tehauntepec, North Tamaulipas. VENEZUELA.

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West Virginia Oil fields gives the production of Burning Springs as 500 bbls. per day; White Oak, 200 bbls.; Sand Hill and Horseneck, 100 bbls., and the lubricating oil district 1,000 bbls. The field is described as a narrow strip from 1 to 1½ miles wide, starting at the Ohio River, near Newport, Ohio, and extending southward about 40 miles.

The Pleasantville, Venango County, and Shamburg, Clarion County, Pools were the most active in 1868. Oil was discovered in Butler County and a showing of oil was uncovered in a test drilled near Bradford, McKean County. The year was a good one for producers as crude oil prices advanced and at the same time oil field equipment and supplies were lower in price than in previous years. Improved methods of transportation also were beneficial to oil operators.

Operations in 1870 were very active over a wide territory. New pools were opened at Fagundus, Colorado and Brady's Bend, all in Pennsylvania Field, and within the general territory embraced by that field and a big gas strike was recorded in Pinegrove Township, Venango County. Engines in wells near the gas strike were run by natural gas introduced directly into the cylinders. In mid-year West Virginia was producing about 2,000 bbls. per day and the oil was selling around $4.10 per barrel. The Petroleum Centre Field was producing 2,400 bbls. per day.

The year 1871 witnessed the rapid decline of the West Hickory and Fagundus Pools, and the peak of production and development work in the Parker's Landing Field. Armstrong Run in Armstrong County became prominent with the development of fourth sand production discovered in 1870.

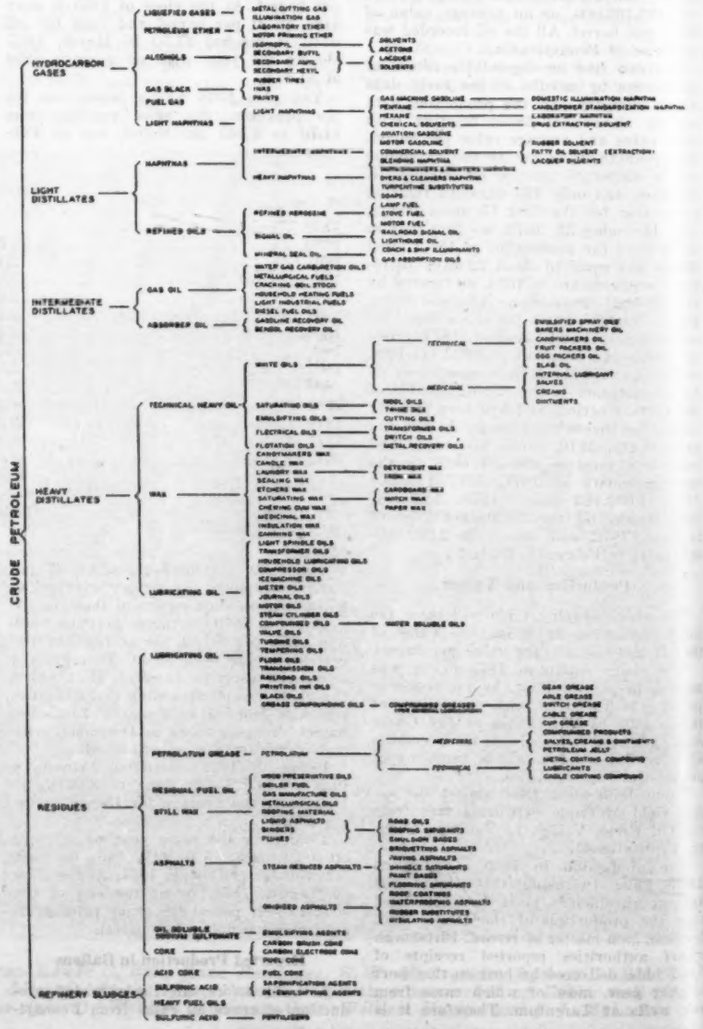
The Cash Up Pool in Venango County was opened and there was much activity along the trend which C. D. Angell laid out in his famous 45-degree line theory. While the Angell theory carried the prospective oil country southwesterly as far as, and including, Kentucky the immediate interest in it extended at that time only from Reno to Bully Hill and Mount Hope in Venango County.

A highly important year in the oil industry was 1872. The Venango County Field, with its many pools, was overshadowed by new pools in Clarion County and Butler County. Short lived gusher wells were common and production increased to a point where the market became glutted and values declined. The year saw the rise and fall of the South Improvement Co. and the birth of the first natural gas plant in the oil region. Gas was piped from a well known as the Newton gasser, 5½ miles to Titusville, supplying fuel and light to 250 customers. At the beginning of the year production in West Virginia was said to be 3,000 bbls. a day and in Pennsylvania about 15,000 bbls. per day.

Clarion, Butler and Armstrong Counties continued to overshadow the older fields of Venango County in 1873 and production rose to the highest point in the first 15 years of the oil business. The production for the year averaged 27,100 bbls. per day but the pipe line runs exceeded the shipments to refiners and crude oil stocks increased while prices of crude dropped to the lowest average since 1862. The attempt of producers to bring production down to demand by shutting in wells ended in failure.

Shipments of oil by rail had by the end of the period almost put water transportation out of business. There were a number of short pipe lines but they were all confined to the oil country.

LIST OF PRINCIPAL PETROLEUM PRODUCTS



Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

THREE PIPE LINES TO EASTERN SEABOARD FEATURED ACTIVE TRANSPORTATION ERA

TRANSPORTATION—ERA NUMBER 2 1874-1889

While hundreds of miles of pipe lines were constructed in the first period of the industry's history, real development and constructive achievement took place during the second era, from 1874 to 1889. During this period it was demonstrated that crude oil could be pumped over mountains. This fact led to the construction of three trunk pipe lines to the seaboard, thereby realizing the dream of many of the pioneers whose struggles with teamsters and "pond freshets" and titanic battles with the railroads which opposed pipe line transportation marked one of the most intensely interesting periods in the history of the petroleum industry. Few people at this time can realize the cutthroat competition which existed in all phases of the oil business during the early days. We rage now at politicians who seem subservient to political interests, but in the early days of the petroleum industry, especially in connection with transportation, less hardy and determined men than those engaged in the oil business would have been crushed by the opposition of railroads and other strong interests and of politicians on the payroll of powerful influences.

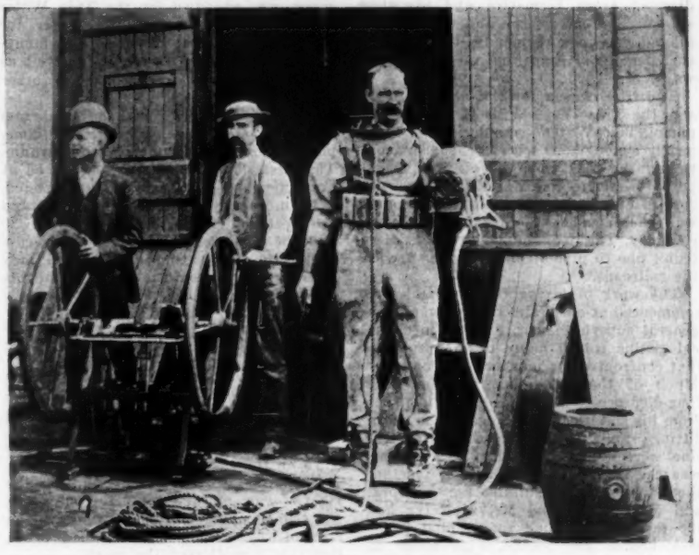
Outstanding in this second era of the history of the petroleum industry is the Tide Water Pipe Co., Ltd., and its officials. Despite all opposition, which was more intense than we can visualize today, and against all ridicule this company laid a pipe line from Coryville, in the Pennsylvania oil region, near Bradford, across the Allegheny Mountains to Williamsport, Pa., and was largely instrumental in the development of machinery and equipment to make possible the pumping of crude oil over high elevations. This feat changed the entire pipe line industry outlook. Leading men in the industry at the time scoffed at the idea that crude oil could be piped over mountains. When crude oil began to flow into tanks at Williamsport from the Tide Water pipe line on June 4, 1879, transportation of crude oil in the United States entered a new era.

The immediate result was the construction by the National Transit Co. of a twin 6-inch pipe line from Olean, N. Y., across the State of New York to Bayonne, N. J., and another line from Colegrove, Pa., to Philadelphia. The Tide Water finally succeeded in extending its line from Williamsport to Bayonne, completing the project to the seaboard before the end of this era.

Railroads Opposed Lines

While the railroads were intensely interested in the transportation of crude oil, they waged a bitter warfare against pipe lines which would deprive them of the transportation of this product. They refused permission for pipe lines to cross their railway rights of way.

In the spring of 1874 Doctor Hostetter, a prominent citizen of Pittsburgh, widely known through his patent medicine "Hostetter's Stomach Bitters," began the construction of a 3-inch pipe line from Millerstown, Butler County, to Clairview, near Pittsburgh. The line had a capacity of 3,500 bbls. per day and extended from producing wells to refineries. Doctor Hostetter's line crossed under the Pennsylvania Railroad through an opening for which he claimed he had secured the right of way. However, soon after operations had commenced, the railroad sent an engine to the culvert. A hook and chain were fastened to the pipe and the engine was started, parting the pipe and wrecking the line at that point. J. G. Benton, an oil producer of Titusville, suggested a solution of the problem. The pipe line reached the railroad at a highway. Mr. Benton believed that it would pay to operate the line, even at the expense of building storage tanks on each side of the railroad and carting the oil across the tracks on the public highways. He had no capital of his own to invest, but he took his plan to D. McKelvy & Co. This firm decided to lease Doctor Hostetter's line, known as the Columbia Conduit line. By June, 1875, it had tank wagons with a capacity of 1,000 bbls. hauling oil across the tracks. There the oil was dumped into tanks and then pumped on to Pittsburgh. The final destination of the oil was to have been certain Pittsburgh refineries. By the time the pipe line was in operation, however, these had been bought up by interests opposed to the new company. For a short time the Baltimore & Ohio Railroad carried the crude to a Baltimore refinery. Then arrangements were made with the Chesapeake & Ohio Railroad to carry the oil from Huntington to Newport News. Twelve barges transported the oil to Huntington from the end of the pipe line. It was a very round-about route, but it kept the Columbia Conduit Co. going successfully until the fall of 1877 when Doctor Hostetter sold the line to the Standard Oil Co.



Diver in charge of pipe lines under water

Line to Seaboard Projected

Apparently more profit could be made from operating a pipe line than producing oil. The new company decided to buy the Seaboard Pipe Line, a project started by Henry Harley in 1876. Mr. Harley had planned to build a line from Brady's Bend to Philadelphia or Baltimore.

When Messrs. Benson, McKelvy and Hopkins put their money into this new proposition they had in mind a refinery at Sparrows Point, Md., and a big trunk line connecting with it. But when they tried to raise capital for the enterprise they found that people were afraid to invest in a plan sure to be unpopular with the railroads and therefore sure to be fought.

The Seaboard scheme had to be abandoned for the time. But its possibilities had gripped the imagination of its promoters—they saw what it could do for the oil industry, and they kept it in mind. Meanwhile they turned their attention to the new situation in the oil fields. The Butler County fields were no longer producing heavily. The Bradford fields would evidently surpass them and become the oil center.

Accordingly the plans were changed and it was decided to build a pipe line starting from the Bradford region.

John P. Townsend, a Quaker, was one of the men who was instrumental in raising capital for this scheme. Through him Mr. Benson met Mr. Gowen, an eminent lawyer, who, in 1878, was president of the Reading Railroad. Mr. Gowen was a "progressive," and his road had long been engaged in a struggle with the Pennsylvania Railroad, which at that time had all the oil traffic and was enjoying the profits of monopoly.

Mr. Gowen became interested in the plan of the pipe line promoters to build a 6-inch line from the Bradford fields to Williamsport, and there connect with the Reading Railroad, which would carry on the crude oil in tank cars to Philadelphia and New York.

An arrangement was made whereby the Reading Railroad agreed to invest $250,000 in the stock of the new company, provided the remaining capital for the pipe line could be raised.

Up to this time the largest pipe line was 3-inch, and it was laid a comparatively short distance. The new project was too big for the imagination of the oil men. It was, in effect, a seaboard line, and it involved pumping oil up and down over mountains. "It can't be done," said the people who knew, but there were some men who figured that this was no more of a speculation than oil producing itself, and still others who had faith in the new company and believed that the men promoting it could carry through whatever they would attempt.

Tide Water Pipe Co. Formed

Eventually the money was raised, and on November 13, 1878, Byron D. Benson, H. L. Taylor, A. A. Sumner, David McKelvy, David B. Stewart, George H. Graham, J. H. Simonds, L. H. Smith and B. B. Campbell met in the old offices of D. McKelvy & Co. on the third floor of the Ralston & Harrington Building in Titusville, and signed the organization papers. The men who first signed these, and 17 others who signed later, were nearly all actively engaged in oil producing. The company was capitalized at $625,000, of which $500,000 was in cash, and the remaining $125,000 was represented by the rights-of-way of the Seaboard Pipe Line, which were never used.

The new company was organized under the Limited Liability Partnership Act of

Many men and tongs were needed to lay a pipe line in the old days

Pennsylvania, as at that time there was no power to organize a pipe line company in Pennsylvania under any other law. All pipe lines operating before this time had been organized by virtue of special charters. Since the Pennsylvania Railroad was virtually in control of the Pennsylvania legislature, it was impossible to obtain another pipe line charter.

The Limited Partnership Law was enacted in 1874, and was the first of its kind. There were no precedents to follow; every application and interpretation of the law had to be worked out on the principle of first impressions. Mr. McKelvy, as first counsel of the company, had to blaze the way. He planned and directed every formative and executive act of the enterprise, and successfully piloted the new company through the turbulencies of launching into uncharted ways.

The title chosen for the new company was the Tide Water Pipe Co., Ltd. The name "Tide Water" was decided upon as nearly synonymous with "Seaboard," conveying the idea that the oil was transported direct to tide water. This was not carried out in fact at the beginning, but was cherished as the final aim of the company. The line was, however, the first trunk line to pipe oil in competition with the railroads.

The work of laying the pipe line was commenced at once. Mr. Benton was made general superintendent, and his mechanical genius solved many of the problems that confronted the pioneer pipe company. Much of the equipment for this first long-distance trunk line was furnished from his specifications. Some of the heavy fittings and tools for constructing the line were designed by him. Because this was the first big line to be put together there were no tools suitable for the work, and Mr. Benton and Mr. McKelvy had the task of designing tongs, pipe jacks, jack boards and swabs. Pipe tongs in general use today are simply a modification of those used in laying the original Tide Water line.

New Type of Pump Tested

Up to this time 3-inch pipe had been the largest handled, and new specifications had to be worked out for the 6-inch fittings, such as gate valves, flanges, unions, tees and ells, that would stand the high pressure required. These were so well planned and constructed that some of the original fittings were still in use after 44 years of almost continuous service.

Mr. Benton had discovered while in charge of the Columbia Conduit that the direct-acting pump was not economical because it did not use steam expansively, and he advocated a pump driven by a separate engine, which would utilize the expansive power of the steam. He also advocated a triplex pump, the three plungers to be driven by a crankshaft so arranged that each plunger would begin its downward or pressure stroke an instant before either of the other plungers had begun its upward or idle stroke, thus obtaining uniform pressure and preventing the jar at the end of each stroke of the direct-acting pump. His recommendation was approved.

When the pump was tested, the original castings for the valve chests and cylinders proved so porous that the oil came through in streams. The president of the company which furnished the pumps was present when the pump was started. He remarked that it was his first actual knowledge of the meaning of the word "pressure," although he had been manufacturing and testing pumps all his life. The test, however, proved that Mr. Benton had the right idea, and this style of pump was specified for the Tide Water stations. As a result Tide Water for many years had the distinction of pumping oil at a lower fuel cost, as well as at less cost per barrel, than any other pipe line.

It was planned to lay the line from Coryville, McKean County, to Williamsport, Lycoming County, Pennsylvania. The first pumping station was to be at Coryville, and No. 2 station at Olmsted, 22½ miles beyond. Between No. 2 and the terminal at Williamsport was 80 miles of rough, mountainous country, covered with heavy timber. Practical men insisted that oil could not be pumped this distance over such land, and bets were made that the project would fail.

Conditions of Land Grants

Mr. Benton took up his headquarters at Williamsport. Telegraph connections were made with Coryville, and later with Bradford and Titusville on the west, and Philadelphia, Thurlow, Bayonne and New York on the east.

The first work was cutting out the right-of-way and clearing the sites for the two pumping stations. To secure the right-of-way, conditions often had to be met that complicated the work.

For instance, the grant from A. G. Olmsted was given on condition that a telegraph office be maintained at Coudersport, Pa., for commercial work. This was carried out, although it entailed 4 miles of looped line, an operator, and an arrangement with the Western Union Telegraph Co. to handle the business.

Some of the grants required that the pipe be laid in a particular place, and others that it be laid before a certain date. Such grants gave the opponents of the pipe line a weapon. The railroads did not welcome this new competition and did all they could to prevent the completion of the line. When their agents learned of these conditional grants they bought options on the farms where they believed it would be difficult to meet the terms of the grant.

The law required that the grant should be entered for record within a certain time; failure to do so amounted to forfeiture in the event of a change of ownership of the farm. On the day before the time allowance expired, the right-of-way man for the Tide Water Pipe Co. received a quiet hint that the Peet farm had been sold. He found that the unrecorded grant was with others in Williamsport. He telegraphed to have them sent to him on the first train. The telegraph operator at Williamsport, later general superintendent of the Tide Water Co., was the messenger to carry the papers, and he tells the story graphically.

"There was no through train, and it was necessary to leave Williamsport at 7:10 a.m., go to Emporium Junction and wait for a train that reached Port Allegany late in the afternoon. A 17-mile drive lay ahead of us. Mr. Warren, the right-of-way man, met us with a notary, identified the grant he wanted by the light from his cigar, drove to Peet's, obtained his acknowledgment and got back in time to enter the paper for record a few minutes before midnight, having arranged with the recorder to wait for him."

Hardships of Construction

The Reading Iron Co. began shipping pipe January 30, and the National Tube Works on February 12, 1879. The nearest point of railroad delivery was from 7 to 13 miles away from the pipe line site. Much of the pipe had to be hauled from 20 to 30 miles over mountainous and frequently unbroken roads in severe winter weather. Men had to go ahead of the teams and cut out trees and underbrush to make a roadway. A single joint made a load for a team in this winter wilderness. The railroads did not exert themselves to hurry the pipe forward, and it was often difficult to keep the teams hauling pipe to the right-of-way supplied. Later men were put on the road to follow the shipments through to their destination and expedite matters and the work progressed more rapidly after this.

The work of putting the pipe together was new to the men, and progress was slow, but it must have been done remarkably well, as when it was completed it was practically tight.

The joints of pipe averaged only 17½ feet in length and did not cover miles as rapidly as does the pipe laid today. Laying pipe with the equipment of those days, a gang of 11 men and a foreman could run a single 6-inch line 3,000 feet a day.

The first work on the pipe line was begun in midwinter. In many places in the mountains the snow lay 5 feet deep. The mercury was below zero most of the time. The men were exposed to the bitterest cold of winter. No pipe line of this kind had ever been laid before, so the men started the work unfamiliar with the job and without adequate tools for handling pipe of this size. The history of industry records no more heroic feat than the laying of the first pipe line across the Alleghenies in the dead of winter.

By the time the pipe was laid through to Williamsport the pumping stations were completed and on May 28, 1879, the pumps at Coryville were started and oil began to flow. Pressure rose rapidly after a few miles, however, and before long it was apparent that something besides oil was being forced through the line. The pumps were stopped and on opening the pipe a piece of wood over 3 feet long and 7 feet of rope, as well as any number of stones, were discovered. No one knew how they got there, although many had their suspicions, but fortunately no damage had been caused—only delay.

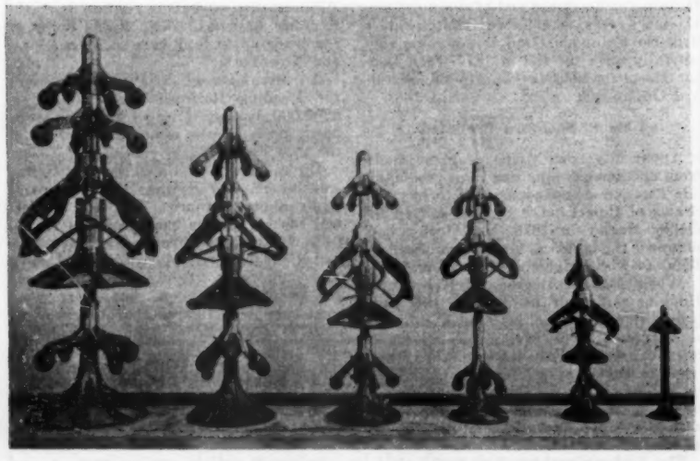
The pipe was cleaned and again connected. The pumps were started once more and within 36 hours oil was flowing into one of the terminal tanks at Williamsport, this being on June 4, 1879.

The oil flowed about as rapidly as a man could walk. It was accompanied on this momentous test by the young son of the president of the company who was himself to be president of Tide Water.

The little plant could transport 10,000 bbls. of oil a day for 109 miles. At Coryville on the edge of the Bradford Field two iron tanks, each holding 25,000 bbls. of oil, were connected with the new pump. This was driven by a 70-horsepower engine. The second station and pump were 28 miles away and 700 feet higher. Up to this time oil had never been pumped beyond 30 miles or up to and over any great elevation.

The impossible had been accomplished, and oil was flowing over the mountains. The slow moving wagons with their leaky barrels, and the railroads with their discriminations and high rates became things of the past. A more economical and efficient method of transporting oil had proved successful.

Laying pipe line at Shadyside, N. J.



"Go-Devils" for cleaning pipe line

Reduction Is Consequence

An immediate consequence of the success of the pipe line is related by John C. Welch in the North American Review, February, 1883. "June 23, 1879, the rate from the Bradford Field to New York was reduced from 85 cents to 30 cents a barrel . . . the ostensible reason for the reduction of the rate was to oppose the new outlet from the Bradford Field to the seaboard."

That oil could be pumped over the mountains was a demonstrated fact. The next thing was to get a line to the seaboard. All the pipe line companies were competing for the rights-of-way.

In extending its line, first from Williamsport to Tamanend, the Tide Water Pipe Co. found the line blocked near Muncy, but the right-of-way man secured the patent for a strip of land running through Lycoming Creek, and the pipe was laid there. An agreement had been entered into with the Philadelphia & Reading Railroad which bound the pipe line company to pay a penalty of $100,000 to the railroad if, at any time during the contract, the Tide Water Pipe Co., Ltd., should extend its line east nearer the seaboard than Williamsport. This contract was changed later and transportation by pipe line was carried on to Tamanend, Pa. Finally in 1887 the Reading Railroad sold its stock interest in the pipe line, thus automatically severing the contract. There was no longer a reason for giving the road a share in the transportation of crude and one year later the line was extended from Tamanend to the refineries at Bayonne.

The extension was difficult work, especially around Oxbow. Oxbow earns its name from the very high, steep ridges

on both sides of the Lehigh River near Mauch Chunk, Pa. The mountains were so sheer and rocky that no teams could be used. Everything had to be carried by hand or pulled up by rope. Because of the sulphur water in the hard coal mines around, which would corrode the pipe, the joints of pipe had to be suspended. A suspension bridge, 250 feet in length, was built across the river and the railroad to carry the pipe line.

Over the mountains was the first challenge of the pipe line industry—under the ocean was the second. The line had to cross Newark Bay and Staten Island Sound to reach the refinery at Bayonne. The original plan was to carry the pipe across the railroad bridge but right-of-way complications made this impossible. The only recourse was to lay it under water.

The distance was 21,000 feet. All pipe and materials were loaded on canal boats which were moored to the bridge and the joints of pipe, as they were connected, were dropped alongside, an empty barrel attached to every other joint keeping the line afloat. As the work progressed, the line was shoved back. Every 1,000 feet the line was lowered with the aid of tugs and the floats were removed.

Laying the line was only half the trouble. Schooners, tacking back and forth, ran into it. Vessels caught it with their anchors. Boats ran aground over it and the result was breaks and leaks on the average of once a week. It was very difficult to repair these as the joints could not be raised and all work had to be done by divers. The following year heavier pipe was put in at a little distance from the bridge. This lasted until 1890 when a 4-foot trench was dug and a new line buried in it.

The Tide Water Pipe Co. was the first concern to transport crude oil over the mountains in pipe lines, but it was to be thwarted in its chief objective—that of being the first pipe line to reach the Atlantic Seaboard. As noted above, the Tide Water delivered oil at Williamsport, Pa., June 4, 1879. It was not until early in 1888 that the company finally succeeded in overcoming all difficulties and railroad opposition and extended its line to Bayonne, N. J.

In the meantime when the Standard Oil Co. realized crude oil could be pumped successfully over the mountains, as demonstrated by the Tide Water's line from Coryville to Williamsport, the National Transit Co., a subsidiary of the Standard, started construction the latter part of 1879 of two 6-inch lines from Olean, N. Y., to New York City and Bayonne. Daniel O'Day was in charge of the construction of these lines, the entire distance of which traversed New York State. Hence the National Transit was the first pipe line company to reach the Atlantic Seaboard, this line being completed in 1881.

National Transit and Tide Water

On October 9, 1883, to take effect October 1, the National Transit Co. for and on behalf of the Standard Oil, made an agreement with the Tide Water Pipe Co. by which the Tide Water was allowed 11½ per cent of the total pipe line transportation of petroleum to the seaboard, this transportation including pipe line and railroad facilities. The agreement also guaranteed the Tide Water $500,000 per year profits for 15 years.

On August 22, 1884, the Pennsylvania Railroad entered into an agreement with all existing pipe lines to the seaboard, this including pipe line and rail facilities, for the maintenance of equal pipe line rates with rail rates in the transportation of petroleum and its products from the oil regions to the seaboard. It was claimed at the time this agreement established considerably higher transportation rates than had been formerly imposed by rail transportation alone.

The passage of the Interstate Commerce Act in 1887, through which discriminations were forbidden and such contracts with shippers as had been the rule since the late sixties, were made illegal, removed many of the difficulties which had handicapped numerous companies in their efforts to extend pipe line transportation.

The Columbia Conduit pipe line was built in 1875 and was the first 3-inch trunk pipe line extending from Millertown to Pittsburgh, Pa., a distance of 60 miles. The line was owned by Doctor Hostetter, of Pittsburgh.

The Union Pipe Line Co. pumped its first oil from the Bradford, Pa., oil field to Olean, N. Y., November 23, 1875.

The Olean Pipe Line Co. was succeeded by the Empire Transportation Co., owned by the Pennsylvania Railroad Co., in 1876.

The Warren Pipe Line was constructed in 1876 from the David Beatty farm, in East Warren, to a loading rack on the Dunkirk, Allegheny Valley & Pittsburgh Railroad, at West End, Warren, Pa. David Beatty was owner.

GO-DEVIL GOT ITS NAME FROM FEAR OF FARMERS

Soon after the first trunk lines were constructed, trouble was experienced when cold weather caused a paraffin-like deposit to form which clogged the pipe. Chemical solutions failed to dissolve this and a wooden ball scraper was worn out by friction after being pumped through the pipe a very few miles. Finally an arrangement of leather and sheet-iron washers, strung on a bolt, was designed.

The farmers, hearing the rumble of the scraper as it was pumped along under ground, thought the devil was after them and the pipe line men accordingly nicknamed the cleaner the "go-devil."

The "go-devil" as finally evolved, was a device about 3 feet long, consisting of a series of revolving knives which loosened and scraped off the dirt and sediment clinging to the pipes. At one end was a disc approximately the size of the pipe. The flow of the oil forced the scraper ahead, the knives being so set as to give it a rotary movement.

The first pipe lines in the Bradford, McKean County, Pennsylvania, oil field, were the McKean County Pipe Line, the Olean Petroleum Pipe Line, the Empire Pipe Line and the American Transfer Pipe Line.

Merger Was Constructive

The merger into the United Pipe Lines of numerous smaller pipe lines in 1874 marked the first step taken in the direction of settling the question of oil transportation by pipe lines. The advantages of the consolidation quickly commended the new order of things to the public. The United Pipe Lines erected hundreds of 35,000-bbl. oil tanks to store the oversupply of oil, made pipe line connections to all of the tanks at the wells and built pump stations where they were needed to handle the oil. The best pumps and appliances were adopted in improving the service and diminishing its cost. Uniform rates were established and every detail was systematized. The United Pipe Lines Association moved forward steadily, avoiding the faults that had wrecked other pipe lines. It bought or combined the Oil City Pipe Line, the Antwerp Pipe Line, the Union Pipe Line, the Cleveland (Karns) Pipe Line, the Grant Pipe Line, the Columbia Conduit Pipe Line, the Relief Pipe Line, Pennsylvania Transportation Co., Clarion division of the American Transfer Co., the Prentice Pipe Line and the Warren Pipe Line.

A bill to repeal the free pipe line laws was introduced in the legislature of Pennsylvania by Representative Marshall in 1878, and was defeated.

In 1879 the United Pipe Lines bought the stock and interests of the Empire Transportation Co., owned by the Pennsylvania Railroad Co., in the upper and middle oil fields, and began the erection of 35,000-bbl. iron storage tanks. At one time there were in the vicinity of Olean, N. Y., 300 iron oil tanks, having a capacity of 9,000,000 bbls. of oil in storage.

The pipe lines in 1879 were: The Smith's Ferry Transportation Co., West Virginia Transportation Co., George Rice Pipe Line, American Transfer Co., United Pipe Lines, Tide Water Pipe Co., Ltd., Tidioute & Titusville Pipe Line, Franklin Pipe Line, Octave Oil Co. Pipe Line, Fox Farm Pipe Line, Shaffer & Charley Run Pipe Line, T. C. Joy Pipe Line, Pennsylvania Transportation Co., Church Run Pipe Line, Cherrytree Pipe Line, Emlenton Pipe Line, Keystone Pipe Line and Associated Pipe Lines.

The management of the United Pipe Lines in 1880 was as follows: Capt. J. J. Vandergrift, president; J. R. Campbell, treasurer; Edward Hopkins, manager; Dan O'Day, superintendent.

Crude Oil Pipe Lines in 1883

The pipe lines in 1883 were the United, Ohio Transit, West Virginia Transportation Co., Tide Water, Emery, Equitable, Monongahela, McKinney Bros., Union Oil Co., and McCalmont Oil Co. In 1883 the McKinney Bros. and the McCalmont Oil Co.'s pipe lines were acquired through purchase by the United Pipe Lines.

From 1870 up to 1884 the production of crude oil each year was greatly in excess of its consumption for all purposes. Consequently oil accumulated and was stored in iron tanks at Colegrove, Tiona, Warren, Oil City, Parkers Landing, Pa., and Olean, N. Y. In August, 1884, this accumulated crude oil reached the enormous maximum amount of 39,083,464 bbls. of oil above ground. The oil in overproduction was valued, in 1884, at $40,000,000.

The United Pipe Lines operated under three divisions, the Upper or McKean County, division; the Middle division from Warren to Franklin, Pa., and the Lower division—Clarion, Armstrong, Butler and Allegheny Counties, Pennsylvania. On May 12, 1884, the United Pipe Lines were transferred to the National Transit Co. and the three divisions were merged into one grand division of the United Pipe Lines division of the National Transit Co. The National Transit Co. operated under the original charter granted Andrew Howard. J. S. Swartz and others, reported to have been employed as "lobbyists" by a railroad company. This charter is known as the Pennsylvania Co., or No. 5, and is identically the same as the South Improvement Co., known as No. 2. By the terms of those charters, if carried out, the Pennsylvania Railroad Co. would have been the "king pin."

The National Transit Co. bought the Pennsylvania Co. charter, under which the National Transit Co. was organized, March 8, 1881, for $16,250.

The Free Pipe Line Bill was introduced in the Senate of Pennsylvania by Senator Lewis Emery, Jr., from Bradford, Pa., in 1883, and was passed in the same year.

The first pipe line in Lima, Ohio, was the Edwards Pipe Line, which began buying Lima oil in April, 1886, at 40 cents a barrel. On May 1, 1886, the Buckeye Pipe Line (branch of the Standard Oil Co.) began the building of a 35,000-bbl. iron oil storage tank on the Ben C. Fourot lands, Lima, Ohio, and on May 11, 1886, commenced buying Lima oil in the field at 40 cents a barrel, and on the first of June, 1886, began to build the Solar refinery near the C. & A. Railroad at South Lima, Ohio.

The Billingsley pipe line bill was introduced into the legislature of Pennsylvania in 1887 by Representative Billingsley of Washington County.

The Western and Atlantic Pipe Line was organized with Joseph H. Craig, president and general manager. The line was known as the W. & A. and the Craig-Elkins & Kimble Co. This company began building pipe lines in the Washington and Taylorstown oil fields in 1887. Storage tanks were first built near the Baltimore & Ohio Railroad at Washington and Taylorstown, Pa. In the spring of 1883 it began laying pipe lines in Armstrong, Allegheny, Beaver and Butler Counties, Pennsylvania, and built storage tanks and oil loading racks on the Pittsburgh & Western (Baltimore & Ohio) Railroad near Mars, Pa. The Western & Atlantic Pipe Line sold its pipe lines, storage tanks and loading racks to the National Transit Co. (Standard Oil Co.) in December, 1889.

The Eureka Pipe Line Co., principal office Oil City, Pa.; chartered under the laws of West Virginia, December 22, 1890; authorized capital, $2,000,000; par value shares, $100; amount paid in, $100,000. Incorporators: Daniel O'Day, Buffalo, N. Y.; C. N. Payne, Titusville, Pa.; C. W. Archbold, Parkersburg, W. Va.; H. W. Sweeny, Oil City, Pa., and J. R. Campbell, Oil City, Pa.

California

The pipe line development in California began in 1880 with the construction of a 2-inch pipe line by the Pacific Coast Oil Co. (which had taken over the properties of the California Star Co. and the Santa Clara Oil Co.) from wells in Pico Canyon to the refinery at Newhall. This line was soon followed by a short length of 2-inch line from Moody Gulch wells to the railroad station at Alma.

In 1884-85 the Mission Transfer Co. built a system of 2 and 3-inch lines from Pico Canyon to a refinery at Santa Paula and shortly thereafter laid an extension of 4-inch pipe to tidewater at Ventura. All of these lines were gravity lines, much of the 4-inch line being suspended by cables along the face of cliffs because of the very rough country traversed.

The Pacific Coast Oil Co. took advantage of this outlet to the coast. It began the construction of two steamers for transporting oil to the Alameda refinery on the San Francisco Bay, and upon their completion abandoned the tank car methods of transportation.

In 1886 a 2-inch line was built to a railroad loading rack from Puente. Another pipe line was built to Los Angeles Basin by the Puente Oil Co. (subsequently owned by the Shell Co.)

TANKER TRANSPORTATION BEGAN IN THE EARLY 60s

The first transoceanic shipment of oil was in 1861 when the rapid decrease in whales and the attendant shortage of sperm and whale oil had made the question of producing a cheap, safe and efficient illuminant an important problem. It consisted of a 5-bbl. shipment from Philadelphia to London. In November of that year, Peter Wright & Sons chartered a 224-ton brig, "Elizabeth Watts," to load a cargo of barreled oil for London. In the year 1864 the entire petroleum exports from all United States ports amounted to 31,754,687 gallons.

The first oil tanker—a sailing vessel—was loaded with petroleum at Port Sarnia on the River St. Clair, Canada, and was lost in the Gulf of St. Lawrence as she was about to enter the Atlantic.

The first iron sailing vessel was the Atlantic, built in Great Britain in 1863. The "Charles" was probably the first vessel fitted with iron tanks for the transport of petroleum. She had 50 separate tanks with a total capacity of 714 tons and carried crude oil between the United States and Europe during the years 1869-72.

Every year up to 1878 wooden vessels were adapted to carry oil in bulk, the holds themselves forming the tanks. The start of the tank steamer may be dated around 1872. In that year Palmer & Co. of England built the "Vaterland" of 2,748 tons for the Red Star Steamship Co. of Antwerp. She was followed by others of similar type in 1873 and 1874. By 1885 the export of American oil in a single year was accomplished by over 1,000 vessels mostly foreign ships, carrying from 2,500 to 14,000 bbls. per voyage. Improvements continued to be made in the construction of tankers until at the present time boats of more than 100,000 bbls. capacity are in operation.

STANDARD SPECIFICATIONS FOR OIL WELL EQUIPMENT WERE ADOPTED EARLY

DEVELOPMENT—ERA NUMBER 2 1874-1889

There was no marked change from conditions developed during the first 15-year period in type of equipment used or general methods of doing business in the relatively new oil industry during the second 15-year period, or between 1875 and 1889 inclusive. The cable tool method was generally used. A few wells were drilled by the Canadian system, but this was really a variation of percussion drilling

Bonanza Flats grasshoppers

so it can be classified in this general category. It is true that drilling machines were used more extensively during the second 15-year period than in the first 15 years. Their use was made possible by the fact that the holes drilled were relatively shallow and by this time experienced drillers familiar with the formations to be penetrated were available in all fields.

The cable tools had been increased in weight from 100 to 200 pounds to the set to 2,000 to 3,000 pounds. Manila rope was replacing "sea grass" lines and the mechanical details of all drilling operations were simplified. Drillers were usually men who had been trained in their work by several years of experience. The helpers went into the business with the understanding that they too must serve several years of apprenticeship before they would qualify as drillers. Thus the art of drilling for crude oil had advanced from the "springpole" haphazard methods of the salt well days to a well organized business with good equipment and mechanics available.

The power was all furnished by steam boilers and engines. These units had been increased in size from 6 and 10 horsepower outfits to units of 40 horsepower boilers and 25 horsepower engines. The engines were of the well known reversing type controlled by telegraph cord from the headache post. Fuel was wood, coal, gas and oil according to local conditions. Steam lines were constructed of much better quality pipe and boilers could be set back from the wells if necessary and steam still be delivered to the engine at high enough pressure to permit all operations to be carried on successfully.

The manufacturers of the East had come to recognize the oil business as affording them an excellent outlet for their equipment and were catering to this business and as a consequence of this competition many improvements were developed and the quality of the material used was much higher than in the early days of the industry.

Scope of Development

The field development was still largely confined to the Pennsylvania oil region at the beginning of the second era and as the demand for the crude was still confined largely to refineries in the eastern states it was only natural that the oil business should prosper and new fields be found in the general area of the original fields marking the birth of the industry. The new fields extended the producing areas and it has been remarked by one writer that instead of fields embracing 3,000 to 4,000 acres the new discoveries extended the known oil region to about the same number of square miles.

It is interesting, however, to note that in 1875 while 14 new pools are reported opened in Pennsylvania, three are reported from California during the same year. The Los Angeles Basin pools were being opened and for the most part were shallow, but there was good demand for the refined products and the search for new fields continued in that State.

After the rather large number of new fields reported in 1875 in Pennsylvania there appears to have been a slowing up of development during the next 10 years in the Pennsylvania oil region but Kentucky and West Virginia attracted some attention and new fields were discovered in these states.

California still continued to be an important oil state but during the last five years of the 1875-1889 period the oil play seemed to move westward from Pennsylvania into Ohio and Indiana and during 1886 the most important discoveries of the year were in those states. This trend of development was due to the growing market for kerosene in the Middle West and the rapidly developing western states into which the new railroad lines were being laid and new settlements opened. The nearer the oil fields were to the refineries supplying the needs of this vast new territory the lower the costs, and transportation played a very important part in handling oil in those days when most of the crude and its refined products were shipped by rail.

The development in the Lima-Indiana and southeastern Ohio areas naturally moved westward into southeastern Illinois and this district was opened in the latter part of the second period with the field at Sparta in Randolph County discovered in 1888.

Equipment Development

In 1889 oil was found in the Shannon Field in Natrona County, Wyoming. After P. M. Shannon made a trip of exploration over the area he returned to Bradford, Pa., and made his report and secured a drilling machine and tools to drill the first well. This equipment was shipped by rail to Laramie on the Union Pacific Railroad in southern Wyoming and hauled to the location by horses, a distance of about 200 miles to the well site at the north end of the Salt Creek Field, near Casper, Wyo.

This incident establishes the fact that the center of the oil machinery and equipment manufacturing business was in Pennsylvania near the oil fields. Pittsburgh was at the time the "steel" center of the United States and its mills furnished the raw shapes needed for the manufacture of rig irons and drilling tools. The engines and boilers for drilling and pumping were made by several well established manufacturers and were accepted by the operators and drillers as standard.

The drillers for the most part had their preferences as to the particular type of engine or boiler they wanted for the operation. As the business expanded new equipment had to be purchased for there was not much second-hand equipment during the early days of the industry. Later when overproduction slowed up development it was possible to purchase used equipment at prices below the cost of new machinery but in general it may be said that equipment was not moved

great distances from the site where first used because of lack of transportation facilities and high costs of shipping by freight.

The Pennsylvania development during these years was largely along the so-called "22½-degree" trend. It is now known that by coincidence the oil fields of Pennsylvania did occur in a belt with a northeast-southwest trend and during the early days of the industry some one had observed this fact and for a long time this was regarded as one of the necessary requirements for drilling sites. If a new well was opened the drilling sites to the northeast and to the southwest of it on the 22½-degree line were in great demand.

The early drilling was to the so-called "first" and "second" sands and to the "third" sand but by 1875 wells were being drilled as deep as 2,000 feet to pick up the "fourth" and other deeper sands.

These deeper sand wells usually flowed naturally for a time and this class of production was desirable as it permitted the owners to produce their oil at lower costs but with production rate unrestricted this usually resulted in overproduction and lowering of prices.

Price of Oil Well Supplies

Old records covering the period 1878-1899 quote the average prices of oil well supplies that were needed to make up the outfit of a drilling and pumping well based upon an average well depth of 1,000 feet. These items for the 1,000-foot wells are considered standard and if the hole is deeper it is only necessary to add for extra tubing and sucker rods. Apparently casing was not increased. The list of equipment usually used is shown in the table below.

To estimate costs of wells deeper than 1,000 feet but not more than 1,800 feet deep add $28.50 per 100 feet of extra hole for additional tubing and sucker rods for wells drilled in 1878. This would make the cost of material for a 1,500-foot hole average about $142.50 more than the 1,000-foot well or cost $1,003.57. For the other years add $26 per 100 feet in 1882; $19 in 1886 and $18.25 in 1889.

It is further stated that "much of the increased cost of deep sand wells of the Southwest (Washington County, Pennsylvania) is due to the fact that several strings of heavy iron casing, ranging from 10-inch down to 4¼-inch are often required before it is possible to reach the oil bearing formation. In this way a well 3,000 feet sometimes contains 6,000 or 7,000 feet of iron pipe."

In the Bradford Field, Pennsylvania, in 1877 it is reported that "lumber suitable for rig building is sold for $11 per 1,000 feet. It takes from 8,000 to 9,000 feet for a rig. In this district hemlock is used on account of it being more abundant than pine, and making a stronger rig. The high rates of transportation increased the cost of rig building. The price when roads were good was from $375 to $400. At the present time as high as $450 is paid. Teamsters can be hired for $5 per day. They charge from $5 to $10 per 1,000 for drawing lumber to the fields.

"Gas, coal and wood are used in drilling wells, and pumping them by heads. Wood costs about $2.25 per cord, coal from $3.75 to $4.50 per ton at the depot. The gas company charges $3.50 per day for enough to run a drill well and 50 cents daily for pumping wells. In some localities wood is cut on the lease and used in firing the boiler. Contractors charge from 90 cents to $1 per foot for drilling, the work being somewhat easier than in the lower country."

During the active development period in the Bradford Field, Pennsylvania, in the early seventies the boiler and engine used for drilling and pumping are reported as costing $600 delivered at the location.

Early well, hand pumped, at Bonanza Flats

COST PER 1,000-FOOT WELL

Articles—	1878	1883	1886	1889
Casing, 5⅝-inch (250 feet)	$220.00	$160.83	$110.42	$97.92
Tubing, 2-inch (1,000 feet)	220.00	303.33	140.00	130.00
Sucker rods (1,000 feet)	65.00	56.67	50.00	52.50
1 Adjuster	3.67	3.00	2.50	2.50
1 Adjuster board	.40	.40	.40	.30
1 Adjuster tee bolt	1.25	1.00	.83	.75
1 Polish rod	3.00	4.00	2.67	2.75
1 Stuffing box	3.58	2.75	1.83	3.00
1 Valve rod	.97	1.25	.85	.85
1 Casinghead	4.50	3.25	2.25	2.18
1 Working barrel	7.67	8.00	7.00	7.08
1 Set of valves	9.33	9.33	7.00	6.00
1 Anchor	1.58	1.50	1.50	1.25
45 feet belting	41.08	43.21	30.00	28.62
95 lbs. sucker rod line, 150 lbs. tubing line	30.16	27.99	20.55	38.38
Packers	22.00	20.00	20.00	20.00
Elevators, sucker rod	8.00	6.50	6.00	5.85
Elevators, sub	.70	.70	.55	.55
Elevators, tubing	10.33	10.00	9.00	8.50
Drive shoes	25.00	25.00	20.00	20.00
40 feet drive pipe	170.67	169.33	109.33	97.33
R. R. couplings	1.25	1.00	.70	.63
Rubber packing, 5 lbs.	1.50	1.50	1.40	1.40
Hemp packing, 2 lbs.	.80	.70	.70	.70
1 Stand pipe	1.21	1.78	1.07	1.07
Lead lines	3.45	3.33	2.95	2.95
Total cost per well	$841.07	$780.34	$560.19	$532.11

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

> ***The first oceangoing ship to be fitted with iron tanks for the transport of petroleum and to be equipped with pumps for unloading the cargo was the Charles, a Belgian ship, which plied between New York and European ports from 1869. to 1872. Her capacity was 295,000 gallons, in contrast with modern oil tankers that carry more than 4,500,000 gallons.***

Drilling costs are reported as averaging 45 cents per foot and the average depth of wells in this field is about 1,600 feet.

The shooting of the hole, common practice in all fields in those days, cost about $100 and tankage for a lease of 10 wells is estimated at $300. The average 100-bbl. capacity wooden tank cost about $60 erected.

Cost of Deep Wells

The most expensive drilling in the oil country in 1889 was for drilling wells in Washington County, Pennsylvania, known as the Southwest territory and the following tabulation covers these costs:

Derrick, erected	$500
Boiler and engine in place	700
1,000 ft. 7⅝-in. csg. @ 80 cents	800
2,000 ft. 5⅝-in. csg. @ 36 cents	720
2,400 ft. 2-in. tubing @ 10 cents	240
2,400 ft. drilling @ $1 per foot	2,400
One 250-bbl. wooden tank, erected	100
Sucker rods and pumping outfit	480
Estimated total cost	$5,940

The trend of production had been followed from Venango and Butler Counties in Pennsylvania into West Virginia and the pay sands found at ever increasing depths with wells drilled to 3,200 and 3,600 feet in West Virginia territory. These wells are reported as being much more expensive to drill and after all equipment possible had been salvaged at a dry hole it is estimated that the cost of the test would be about $6,000, "a not very inviting prospect, even on a highly favorable market."

Total Completions

According to a report by Henry R. Wrigley in the Second Geological Survey 5,560 wells had been drilled in the oil region of Pennsylvania in the years 1859-1868, inclusive. Professor Wrigley further states that:

In 1869 wells drilled	931
In 1870 wells drilled	1,607
In 1871 wells drilled	946
In 1872 wells drilled	1,033
In 1873 wells drilled	530
In 1874 wells drilled	432
Total	4,939
Prior to 1869	5,560
Total to Dec. 31, 1874	10,499

This record makes no mention of the dry holes drilled during this first 15-year period of the oil industry and it is estimated that the dry holes may have totaled 7,500. Records of wells drilled in fields outside of Pennsylvania do not seem to have been very complete but it is reported that 85 new fields were opened in this country between 1859 and 1874 inclusive in Pennsylvania, Kansas, Kentucky, California, West Virginia and Tennessee.

The field operations in the Pennsylvania oil regions embracing southwestern

Shallow producer drilled in Newhall Field, Los Angeles County, Calif., by California Star Oil Co., predecessor of Standard Oil Company of California. Depth 1,000 feet. Date completed 1876

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New York, western Pennsylvania, West Virginia and the eastern and southeastern portions of Ohio in the light oil fields, but not embracing the lubricating oil fields of Ohio and Pennsylvania are reported in the Oil City Derrick Handbook as follows:

Year—	Comp.	Dry	Total	Per cent oil wells
1875	544	106	650	$3.75
1876	2,319	328	2,647	$7.50
1877	3,955	658	4,613	$7.00
1878	2,988	328	3,316	90.00
1879	2,816	148	2,964	95.25
1880	4,213	144	4,357	96.50
1881	3,873	182	4,055	95.50
1882	3,268	179	3,447	95.00
1883	2,913	261	3,174	92.00
1884	2,360	270	2,630	$9.50
1885	2,942	379	3,321	$8.50
1886	3,670	607	4,277	$5.75
1887	1,715	437	2,152	79.60
1888	1,557	389	1,946	$0.00
1889	5,621	957	6,578	$5.50
Total ..	44,754	5,373	50,127	$9.50

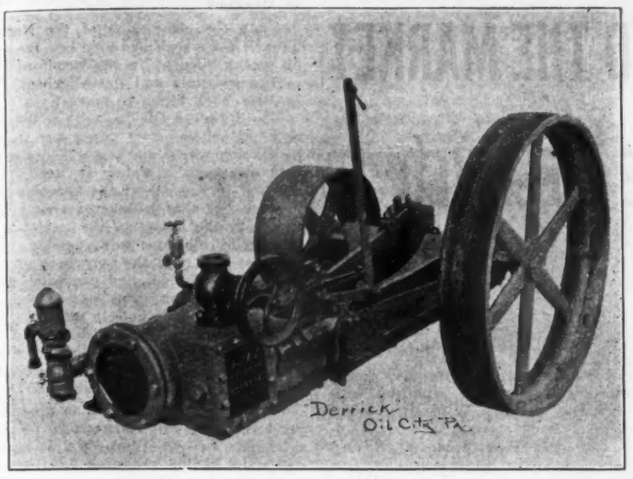
This high percentage of oil wells to completions may be accounted for by the fact that wells were usually drilled close together and in what was then termed the "belt" or "trend of production" and wildcatting as later practiced in the Mid-Continent and Rocky Mountain areas was then unknown.

One outstanding fact is the relatively short life of a great many of these wells. This is probably due to relatively low investment and variable demand for oil, making new flowing wells more profitable to produce than pumping old ones.

If the average well cost $6,000 and would produce 200 bbls. of oil per day bringing prices ranging from 66⅝ cents, the low of 1887, up to $2.57⅝, high average for 1876, and the average for the 15-year period $1.11½ it will be seen that the original investment could be returned in a very short time. The average life of the wells of this second 15-year period was about seven years.

This does not mean that some of the old wells are not still producing or that many of them were not later revived, but it reflects the trend of development during that time and indicates the demand for machinery and equipment, because even though in the estimates referred to it is assumed that much of the machinery could be recovered, it is known that new equipment was purchased for most of the new operations.

Such a condition induced the manufacturers to constantly improve their equipment and machinery and later led to the deeper drilling in new wildcat territory outside of the original Pennsylvania oil region during the third 15-year period of the oil industry.



One of the early type steam drilling engines

OIL DISCOVERED 1875 TO 1889

Year	Province—	State—	Field—	County—
1875	Appalachian	Pennsylvania	Bullion	Venango
	Appalachian	Pennsylvania	Cowanshannock	Armstrong
	Appalachian	Pennsylvania	French Corner	Armstrong
	Appalachian	Pennsylvania	Glade Run	Warren
	Appalachian	Pennsylvania	Limestone Run	Armstrong
	Appalachian	Pennsylvania	Madison	Armstrong
	Appalachian	Pennsylvania	Mahoning Furnace	Armstrong
	Appalachian	Pennsylvania	Shannondale	Clarion
	Appalachian	Pennsylvania	Sheffield	Warren
	Appalachian	Pennsylvania	Sherrett	Armstrong
	Appalachian	Pennsylvania	Smethport	McKean
	Appalachian	Pennsylvania	Summit	Butler
	Appalachian	Pennsylvania	Wardwell	Warren
	Appalachian	Pennsylvania	Winfield	Butler
	California	California	Newhall	Los Angeles-Ventura
	California	California	Pico	Los Angeles
	California	California	Santa Paula	Ventura
	California	California	Adams Canyon-Tar Flat	Ventura
1876	Appalachian	Pennsylvania	Economy	Beaver
	Appalachian	Pennsylvania	Garrison	Greene
	Appalachian	Pennsylvania	Glade Mills	Butler
	Appalachian	Pennsylvania	Kane	McKean
	Appalachian	Pennsylvania	Kennerdell	Venango
	Appalachian	Pennsylvania	Whitley Creek	Greene
1877	Appalachian	Pennsylvania	Cookson	Allegheny
	Appalachian	Pennsylvania	Lafayette	McKean
	Appalachian	Pennsylvania	Lake Creek	Crawford
	Appalachian	Pennsylvania	Ridgway	Elk
	Appalachian	Pennsylvania	Tionesta	Forest
1878	Appalachian	Pennsylvania	Clarendon	Warren
	Appalachian	Pennsylvania	Cornplanter	Warren
	Appalachian	Pennsylvania	Fairview	Erie
	Appalachian	Pennsylvania	Hazelhurst	McKean
	Appalachian	Pennsylvania	Kushequa	McKean
	Appalachian	Pennsylvania	Marvindale	McKean
	Appalachian	Pennsylvania	Murrysville	McKean
	Appalachian	Pennsylvania	Tarentum	Allegheny
	Appalachian	Kentucky	Irvine	Estill
1879	Appalachian	Pennsylvania	Cherry Grove	Warren
	Appalachian	Pennsylvania	Wetmore	McKean
	Appalachian	West Virginia	Waverly	Woods-Pleasants
	Appalachian	West Virginia	California Home	Ritchie
	Ill.-S. W. Ind.	Illinois	Litchfield	Montgomery
	California	California	Moodys Gulch	Santa Clara
1880	Appalachian	Pennsylvania	Bullion	Venango
	Appalachian	Pennsylvania	Cherry Tree	Venango
	Appalachian	Pennsylvania	Clarendon	Warren
	Appalachian	Pennsylvania	Corsica	Jefferson
	Appalachian	Pennsylvania	Cranberry	Butler
	Appalachian	Pennsylvania	Dewdrop	Warren
	Appalachian	Pennsylvania	Fairview	Erie
	Appalachian	Pennsylvania	Fisher	Forest
	Appalachian	Pennsylvania	Foster	Venango
	Appalachian	Pennsylvania	Garrison	Greene
	Appalachian	Pennsylvania	Glade Mills	Butler
	Appalachian	Pennsylvania	Kane	McKean
	Appalachian	Pennsylvania	Kennerdell	Venango
	Appalachian	Pennsylvania	Kushequa	McKean
	Appalachian	Pennsylvania	Marvindale	McKean
	Appalachian	Pennsylvania	Murrysville	Allegheny
	Appalachian	Pennsylvania	Tarentum	Allegheny
	Appalachian	Pennsylvania	Tionesta	Forest
	Appalachian	Pennsylvania	Whitley Creek	Greene
	Appalachian	Kentucky	Irvine	Estill
	Rocky Mountain	Wyoming	Dallas	Fremont
	California	California	Puente	Los Angeles
1881	Appalachian	Pennsylvania	Bullion	Venango
	Appalachian	Pennsylvania	Cherry Tree	Venango
	Appalachian	Pennsylvania	Cowanshannock	Armstrong
	Appalachian	Pennsylvania	Dewdrop	Warren
	Appalachian	Pennsylvania	Fairview	Erie
	Appalachian	Pennsylvania	Fisher	Forest
	Appalachian	Pennsylvania	Foster	Venango
	Appalachian	Pennsylvania	French Corner	Armstrong
	Appalachian	Pennsylvania	Glade Run	Warren
	Appalachian	Pennsylvania	Limestone Run	Armstrong
	Appalachian	Pennsylvania	Madison	Armstrong
	Appalachian	Pennsylvania	Mahoning Furnace	Armstrong
	Appalachian	Pennsylvania	Shannondale	Clarion
	Appalachian	Pennsylvania	Sheffield	Warren
	Appalachian	Pennsylvania	Sherrett	Armstrong
	Appalachian	Pennsylvania	Smethport	McKean
	Appalachian	Pennsylvania	Summit	Butler
	Appalachian	Pennsylvania	Wardwell	Warren
	Appalachian	Pennsylvania	Winfield	Butler
	Appalachian	Pennsylvania	Mansen	Elk
	Appalachian	Pennsylvania	Marianville	Forest
	Appalachian	Pennsylvania	New Sheffield	Beaver
	Appalachian	Pennsylvania	Sackett	Elk
1882	Appalachian	Pennsylvania	Hickory	Washington
	Appalachian	Pennsylvania	Shannopin	Beaver
	Appalachian	West Virginia	.....	Brooke
	Appalachian	West Virginia	Wellsburg (Lasearville)	Brooke
	California	California	Piru	Ventura
	California	California	Tapo Canon	Ventura
1883	Appalachian	Pennsylvania	Bailtown	Forest
	Appalachian	Pennsylvania	Juneau	Indiana
	Appalachian	Pennsylvania	Mill Creek	Elk
	Appalachian	Kentucky	Montgomery Field	Montgomery
	Rocky Mountain	Wyoming	Dallas	Fremont
	California	California	DeWitt Canyon	Los Angeles
1884	Appalachian	Pennsylvania	Brookville	Jefferson
	Appalachian	Pennsylvania	Clinton Twp.	Butler
	Appalachian	Pennsylvania	Homewood & Swissvale	Allegheny
	Appalachian	Pennsylvania	Thorn Creek	Butler
	Appalachian	West Virginia	Belmont	Pleasants
1885	Appalachian	Pennsylvania	New Galilee	Beaver
	Appalachian	Pennsylvania	Oneida	Butler
	Appalachian	Pennsylvania	Washington-Taylorstown	Washington
	Appalachian	C. & S. E. Ohio	Bladensburg	Knox
	Appalachian	C. & S. E. Ohio	Mt. Vernon	Knox
	Appalachian	C. & S. E. Ohio	.....	Stark
	Appalachian	West Virginia	Eureka	Pleasants
	Appalachian	West Virginia	Newark	Licking
	Lima-Indiana	N. W. Ohio	Lima	Allen
	Lima-Indiana	N. W. Ohio	Ottawa Twp.	Allen
	Lima-Indiana	N. W. Ohio	Perry Twp.	Allen
	Lima-Indiana	N. W. Ohio	Duchouquet Twp.	Auglaize
	Lima-Indiana	N. W. Ohio	.....	Sandusky
	Rocky Mountain	Wyoming	Newcastle	Weston
	California	California	Sisar Creek (Silverthread)	Ventura
	California	California	Ojai	Ventura
1886	Appalachian	Pennsylvania	Bear Creek	Elk
	Appalachian	Pennsylvania	Braeburn	Westmoreland
	Appalachian	Pennsylvania	Coudersport	Potter
	Appalachian	Pennsylvania	Mount Morris	Greene
	Appalachian	Pennsylvania	Pleasant Unity	Westmoreland
	Appalachian	Pennsylvania	Saxonburg	Butler
	Appalachian	West Virginia	Mount Morris	Monongalia
	Lima-Indiana	N. W. Ohio	Bath Twp.	Allen
	Lima-Indiana	N. W. Ohio	German Twp.	Allen-Auglaize
	Lima-Indiana	N. W. Ohio	Richland Twp.	Allen
	Lima-Indiana	N. W. Ohio	Spencer Twp.	Allen
	Lima-Indiana	N. W. Ohio	St. Marys	Auglaize
	Lima-Indiana	N. W. Ohio	Allen Twp.	Hancock
	Lima-Indiana	N. W. Ohio	Cass Twp.	Hancock
	Lima-Indiana	N. W. Ohio	Liberty Twp.	Hancock
	Lima-Indiana	N. W. Ohio	Franklin Twp.	Mercer
	Lima-Indiana	N. W. Ohio	Jefferson Twp.	Mercer
	Lima-Indiana	N. W. Ohio	.....	Ottawa
	Lima-Indiana	N. W. Ohio	Woodville Twp.	Sandusky
	Lima-Indiana	N. W. Ohio	Clinton Twp.	Seneca
	Lima-Indiana	N. W. Ohio	Hopewell Twp.	Seneca
	Lima-Indiana	N. W. Ohio	Henry Twp.	Wood
	Lima-Indiana	N. W. Ohio	Crane Twp.	Wyandot
	Lima-Indiana	N. W. Ohio	Crawford Twp.	Wyandot
	Lima-Indiana	N. W. Ohio	Salem Twp.	Wyandot
	Lima-Indiana	N. E. Indiana	Union Twp.	Delaware
	Lima-Indiana	N. E. Indiana	Center Twp. (Kokomo)	Howard
	Ill.-S. W. Ind.	Illinois	Pittsfield-Hadley	Pike
	California	California	Half Moon Bay	San Mateo
1887	Appalachian	Pennsylvania	Bakerstown	Butler
	Appalachian	Pennsylvania	Belle Vernon	Washington
	Appalachian	Pennsylvania	Buffalo	Washington
	Appalachian	Pennsylvania	Clifton	Allegheny
	Appalachian	Pennsylvania	Fayette	Fayette
	Appalachian	Pennsylvania	Webster	Westmoreland
	Appalachian	West Virginia	Moundsville	Marshall
	Appalachian	Kentucky	Cloverport	Breckenridge
	Appalachian	Kentucky	Emery	Barren
	Lima-Indiana	N. W. Ohio	Jackson Twp.	Allen
	Lima-Indiana	N. W. Ohio	Jackson Twp.	Auglaize
	Lima-Indiana	N. W. Ohio	Madison Twp.	Sandusky
	Lima-Indiana	N. E. Indiana	Fairmont	Grant
	Lima-Indiana	N. E. Indiana	Barkley	Jasper
	Lima-Indiana	N. E. Indiana	Walker	Jasper
	Lima-Indiana	N. E. Indiana	Greene	Jay
	Lima-Indiana	N. E. Indiana	Amboy	Miami
	Lima-Indiana	N. E. Indiana	Tipton	Tipton
	Mid-Continent	Northern Texas	Nacogdoches	Nacogdoches
	California	California	Seape	Ventura
	California	California	Tar Creek	Ventura
	California	California	Four Forks	Ventura
	California	California	Coalinga	Fresno
1888	Appalachian	Pennsylvania	Canonsburg	Washington
	Appalachian	Pennsylvania	Clarion	Clarion
	Appalachian	Pennsylvania	Hallton	Elk
	Appalachian	Pennsylvania	Masontown	Fayette
	Appalachian	Pennsylvania	Nineveh	Greene
	Appalachian	Pennsylvania	Shamburg	Clarion
	Appalachian	C. & S. E. Ohio	Thurston	Fairfield
	Appalachian	West Virginia	Turkeyfoot	Hancock
	Appalachian	Kentucky	Boyds' Creek	Barren
	Appalachian	Kentucky	Bourbon County	Bourbon
	Lima-Indiana	N. W. Ohio	Logan Twp.	Auglaize
	Lima-Indiana	N. W. Ohio	Noble Twp.	Auglaize
	Ill.-S. W. Ind.	Illinois	Sparta	Randolph
	Ill.-S. W. Ind.	S. W. Indiana	Terre Haute	Vigo
	Rocky Mountain	Wyoming	Moorecroft	Crook
	California	California	Salt Marsh	Ventura
	California	California	Hooper Canon	Ventura
	California	California	Simi	Ventura
	California	California	Scarab	Ventura
1889	Appalachian	Pennsylvania	Cherrytree	Cambria
	Appalachian	Pennsylvania	Hookstown	Beaver
	Appalachian	Pennsylvania	Waynesburg	Greene
	Appalachian	Pennsylvania	Wildwood	Allegheny
	Appalachian	C. & S. E. Ohio	Barnesville	Belmont
	Appalachian	C. & S. E. Ohio	Cadiz	Harrison
	Appalachian	C. & S. E. Ohio	Island Creek	Jefferson
	Appalachian	West Virginia	.....	Marion
	Appalachian	West Virginia	Mannington	Marion
	Appalachian	West Virginia	Cassville	Monongalia
	Appalachian	West Virginia	Dolls Run	Monongalia
	Appalachian	West Virginia	St. Marys	Pleasants
	Appalachian	Kentucky	Glasgow	Barren
	Appalachian	Kentucky	Oil City	Barren
	Appalachian	Kentucky	Somerset	Pulaski
	Appalachian	Kentucky	Steffy	Barren
	Lima-Indiana	N. E. Indiana	Montpelier	Blackford
	Lima-Indiana	N. E. Indiana	Gillam Twp.	Jasper
	Lima-Indiana	N. E. Indiana	Liberty Twp.	Tipton
	Rocky Mountain	Wyoming	Shannon	Natrona
	California	California	Elsemere	Los Angeles
	California	California	Stockton	San Joaquin

BRADFORD, FIRST GREAT OIL FIELD, FLOODED THE MARKET BUT THE FIRST SEABOARD PIPE LINE RELIEVED IT

PRICES—ERA NUMBER 2 1874-1889

At the beginning of 1874,, the crude oil production of the United States was about 30,000 bbls. per day and the market price of crude oil opened the year at $1.65 per barrel. In the 15 years between January 1, 1874, and December 31, 1888, 315,293,000 bbls. of oil was produced, valued at $306,030,000, or an average of 97 cents per barrel. In the 15 years previous, 1859-1873 (counting 1859 as one year, although it was productive of oil in only the last four months), 54,357,000 bbls. of oil was produced, valued at $195,766,000 or an average of $3.60 per barrel.

Up to the close of 1875, Pennsylvania produced all the crude oil of record, although West Virginia produced a little oil years before that time, and marketed it. In 1876, Ohio, West Virginia and California all came into the production picture in a small way, Ohio with a production for the year of 32,000 bbls., West Virginia with 120,000 bbls., California with 12,000 bbls. Pennsylvania produced 8,969,000 bbls. The total production of 1876, 9,133,000 bbls. had an average value of $2.52 per barrel.

No new oil producing states were added to the record until 1887, when the production of New York was first recorded separately, at 6,685,000 bbls. In the same year Pennsylvania produced 23,368,000 bbls.; but Ohio, West Virginia and California were still small producers and the total for the United States had risen to 30,350,000 bbls. valued at $23,631,000, or only 98 cents per barrel.

The evil of overproduction cast its spell over the oil region in the years following 1877. The average price of oil in 1875 was $2.91 per barrel; 1876, $2.52; 1877, $2.38; 1878, $1.17, and then it fell below the dollar mark. In 1878 the market opened at $1.03¾, but it fell in July to 84⅝ cents and in October it dropped to 80 cents, closing the year at an average of 90 cents in December giving the year an average of $1.17 per barrel.

First of Big Fields

The Bradford Field in Northern Pennsylvania, which developed into the largest field of its time and one of the nine largest all-time producers in the United States, had begun to make its influence felt in 1878 when it produced 6,500,000 bbls. of oil out of a total of 15,397,000 bbls. in the United States, or 42 per cent of the total. It reached its productive peak in 1881, when it produced 23,000,000 bbls., in round numbers, out of a total in the United States of 27,661,000 bbls. or 83 per cent of the country's entire output and 77 per cent of all the oil produced in the world in that year. In the three biggest years of the field, 1880, '81 and '82, the Bradford Field produced 63,000,000 bbls. or 74 per cent of the country's production and 64 per cent of the world's production in the same period. No other field since has so nearly monopolized total crude output as the first of the big fields.

Bradford's continued big production in 1882 sent the average price of oil for the year down to 78 cents per barrel. The Bradford Field in the 15 years covered by this period produced 140,166,000 bbls. or 44 per cent of a total of 315,293,000 bbls. produced in the United States, in Pennsylvania, New York, West Virginia, Ohio, California and Colorado, the only producing states up to the end of the period. It was the only very large field developed in the first 30 years of the industry.

Credit Balance Trading

The second of the five 15-year periods making up the 75 years of the industry saw the establishment of oil exchanges where credit balances for oil run from the producing properties into the pipe lines were a matter of trade. In another part of this edition the history of the oil exchanges, their method of operating, and their passing, will be found. It is an interesting story of the evolution of oil marketing.

From $2.75 to 49¼ Cents

In all the 15 years the highest price received for the producer for oil—all of it excepting the California oil being what is known now as Pennsylvania grade—was at the very beginning, $2.75 per barrel. The lowest price received was 49¼ cents per barrel in July 1882. Market prices fluctuated smartly in those times often changing from hour to hour, and even from minute to minute, in a lively day in the exchanges located in Oil City, Bradford, Pittsburgh and New York. The market in the last month of the second 15-year period, December, 1888, had a high price of 93½ cents and a low of 84⅝ cents.

Oil Man's Spirit Unbroken

Nearly 15,000 oil wells were drilled in the Bradford Field of 85,000 productive areas. The oil came so fast that the pipe lines could find a market for only a part of it and the rest went to storage. Great tank farms were constructed in the Pennsylvania Grade fields the largest being in Bradford and stocks rose to 39,086,004 bbls. in August, 1884, enough oil to meet the demands of the refiners for over 19 months if all the fields had quit producing. In 1934 our crude oil stocks on hand are equal to only 132 days refinery demand, but in the summer of '84 they equalled the refinery demand for about 575 days, and yet the oil business did not "blow up" or "go to the wall." Like the chap Mr. Henley wrote about in "Invictus," the oil man stuck his chest out and roared:

"Out of the night that covers me.
Black as the pit from pole to pole,
I thank whatever gods may be
For my unconquerable soul."

Under the bludgeonings of fate his "head was bloody, yet unbowed." In other words he went out after new fields, regardless of the current situation with its very low prices. Wildcatters were active in a dozen states. The Mid-Continent had been penetrated by oil men who were active in Kansas, Indian Territory and Texas. Up in Wyoming Mark Shannon and Barney McCalmont were trying to open a pool, and finally succeeded in opening Salt Creek in the Shannon sand, therefore hastening the exploration and later development of Wyoming, Montana, Colorado and New Mexico. But nothwithstanding the work of wildcatters at the close of the second 15 years of oil history, the 27,612,000 bbls. of oil produced in the country came from the following eight states: New York, 2,000,000 bbls.; Pennsylvania, 14,000,000 bbls.; Ohio, 10,011 bbls.; West Viginia, 119,000 bbls.; Kentucky-Tennessee, 5,000 bbls.; Colorado, 298,000 bbls. and California, 690,000 bbls. The year's supply had a value of $17,948,000 or an average of 65 cents per barrel, the lowest average price since the early 1860's.

Seaboard Pipe Line

The reason the Bradford Field was developed so rapidly—the new wells coming in at the rate of hundreds per month at the peak of operations—was that two o the largest pipe line systems, the United Pipe Lines and the Tide Water served the field. The largest of these was the United Pipe Lines (afterward the National Transit Co., owned by the Standard Oil Co). Late in the seventies the company started a tank farm just north of the city of Bradford and in two peak years of the field's production, tanks were built as fast as they could be put together. A record of a tank and third per day, or four tanks in three days, was maintained at the peak of the building campaign. The tanks were of wrought iron and later of steel, and 20,000 to 35,000 bbls. capacity. It is interesting to note that some of the wrought iron tanks built in the late '70's or early '80's are still in use on the Sinclair Prairie Oil Co.'s Neodesha tank farm in Kansas. They had been cut down and rebuilt, doing service in the Lima fields before being moved to Kansas.

There were no pipe lines to seaboard when this storage building campaign started. The pipe line to seaboard had been talked of for years, but there seemed no reason for such a gigantic outlay of capital until the Bradford Field began producing at a rate beyond the wildest dreams of any of the oil men of that period.

Line Decided Upon in 1879

Work on the National Transit's pipe line from the Pennsylvania Grade oil fields to the Atlantic Seaboard was decided upon in 1879. When completed it consisted of two 6-inch lines from Olean, N. Y. to Saddle River, N. J., across the river from Bayonne, N. J. The first oil was run through to Bavonne in 1881.

Previously the Tide Water Pipe Co., Ltd., had laid the first line over the mountains, starting at Coryville, on the edge of the Bradford field and ending at Williamsport. The oil piped through this line was delivered to the Philadelphia and Reading Railroad which conveyed it to the seaboard refinery of the Tide Water at Bayonne.

Upon the completion of the National Transit Co.'s seaboard pipe line the crude oil stocks piled up in the Bradford Field in Pennsylvania and the Allegheny Field in New York began to move East.

The Standard Oil Co., with so much oil on hand, set its smart young men to work to develop world markets. The story of that campaign is a tale in itself but it resulted in the use of the kerosene lamp in countries that had never seen a lamp except in the homes of the wealthy. Illuminating oil came into common use in the homes of even the very poor all over the civilized world, and crude oil stocks would have soon disappeared from the face of the earth had it not been that the ubiquitous wildcatter discovered new sources of petroleum, the discoveries and subsequent development keeping ahead of demand in most of the years since.

Up to the close of 1875, no production was recorded in any state outside of Pennsylvania. In 1876 West Virginia is credited with having produced 120,000 bbls. of oil valued at $298,000 and southeastern and Central Ohio with 32,000 bbls. valued at $92,000. All this was Pennsylvania grade oil. In the 13 years of the second 15-year period in which the two fields above mentioned produced oil West Virginia Field was credited with 1,783,000 bbls. valued at $2,045,000 and southeastern and Central Ohio, with 2,387,000 bbls. valued at $1,723,000.

Kentucky and Tennessee's production started in a very small way in 1883 and was still small in 1888, the close of the second 15 years. In the six years it produced 29,000 bbls. valued at $28,000.

New York state's production was included with Pennsylvania in some of the earlier years and the production of both states in the second 15-year period is recorded as 202,634,000 bbls. valued at $202,559,000.

The Lima Field in northwestern Ohio and the northeastern Indiana Field came into the production record in 1886. The oil had a high sulphur content, absent from the oils in the Appalachian fields, and at first was valued at a very low figure. Lima-Indiana oil was worth 39 cents per barrel as an average in 1886, and 21 cents in 1887; 15 cents in 1888. The 15,471,000 bbls. production of the two areas in the three years was valued at $2,849,000 or 18.4 cents per barrel.

Californians received a good price for the oil they produced between 1876, the first recorded production, and 1888 the end of the second period. The production was small and the local demand keen. In the 13 years California produced 2,805,000 bbls. of crude valued at $6,281,000, or an average of $2.13 per barrel with a top yearly average price of $2.50 and a low of $2.01.

Production began to be recorded in Colorado in 1887 when the state produced 76,000 bbls. The following year it produced 298,000 bbls. The value of the crude is not recorded.

Quantity and Value of Petroleum Produced in the United States 1874 to 1888 (15 Years)

Year	Production bbls.	Value	Ave. per bbl.
1874	10,927,000	$ 12,648,000	$1.16
1875	8,788,000	7,388,000	.84
1876	9,133,000	22,983,000	2.52
1877	13,350,000	31,789,000	2.38
1878	15,397,000	18,045,000	1.17
1879	19,914,000	17,211,000	.86
1880	26,286,000	24,601,000	.94
1881	27,661,000	25,449,000	.92
1882	30,350,000	23,631,000	.78
1883	23,450,000	25,790,000	1.10
1884	24,218,000	20,598,000	.85
1885	21,859,000	19,198,000	.88
1886	28,035,000	19,998,000	.71
1887	28,283,000	18,877,000	.67
1888	27,612,000	17,948,000	.65
Total	315,293,000	$306,130,000	$ .97

REFINING—ERA NUMBER 2 1874-1889

After a period of 15 years during which petroleum refining reflected the unsettled conditions prevailing in the crude producing branch, the art of processing a constantly increasing number of finished products from crude oil by 1874 began to take on the appearance of a permanent manufacturing industry. The flock of promoters who financed and built small refineries in a period of few weeks or months, shortly after the Drake discovery, had decreased in numbers and in most cases their plants had either been abandoned or taken over by operators who were endeavoring to develop a permanent refining industry. A check at the start of 1874 showed the following refineries in operation:

	No. of plants	Cap'y. (bbls.)
Philadelphia	12	2,000
Baltimore	8	1,200
New York	15	10,000
Cleveland	6	12,500
Titusville	11	4,800
Miller Farm	3	800
Gregg Switch	1	200
Pioneer	1	125
Petroleum Center	2	450
Rouseville	2	200
Tarr Farm	1	200
Oil City	3	2,200
Oleopis	1	175
Tidioute	1	50
Pittsburgh	22	6,500
Erie	6	1,200
Boston	..	3,500
Buffalo	2	450
Portland	1	350
Jamestown	1	50
Binghamton	1	50
Total	101	47,000

It will be noted that 60 per cent of this capacity was located in three cities, New York, Cleveland and Pittsburgh, where operations had passed into the hands of a few companies which were constantly building larger plants. New York and other seaboard points were increasing in importance as refining centers due largely to the expanding export demand. In 1875 the large refining capacity at Pittsburgh resulted in a pipe line being built from the fields for the transportation of crude oil. Shortly afterwards a line was built to Cleveland and by 1881 a line had been built to the seaboard. Writers of this period emphasize the importance of these and other trunk lines in their relation to refinery construction and operations. The lines tended to encourage the building of large refineries in place of the many small plants and this in turn stimulated developments looking toward the improvement in refining processing methods. It is contended that if this situation had not come about manufacturing practice would have lagged behind that of European countries. It is true that during this period some of the practices adopted by American refineries had their origin in Russia where the Nobel interests were constantly perfecting new equipment.

First California Refinery

Early in this period interest in refining took a big jump and the first plant was built in California. This construction took place in 1876 following the discovery of crude production in commercial quantities, the previous year in Pico Canyon, California, by the California Star Oil Works Co., which later became the Standard Oil Co. of California. Two small experimental plants were first built—one near the present town of Newhall and the other on the shore of the Pacific Ocean.

The combined capacity of the plants was approximately 60 bbls. daily. Two years later it was decided to combine the two operations at a site close to the field. Accordingly another plant was built 5 miles southeast of Pico Canyon. D. G. Scofield, who later became president of the Standard of California, was in charge of the company operations and he brought Charles D. Kellogg and J. V. Morrison from Titusville, Pa., to build and operate the refinery.

The distillation equipment consisted of two "cheese box" stills. The crude was brought over the mountain to a storage tank above the refinery in a 2-inch cast iron pipe. An unusual feature was the provision to charge the stills by gravity from the storage tank, the crude discharging through a spray finely divided with steam. The kerosene distillate required a heavy acid treatment and this was done in a lead lined tank which served as an agitator. The plant produced a burning oil which found a ready market on the West Coast where kerosene from Pennsylvania was being sold in tins around 60 cents per gallon. Part of the residue was mixed with a distillate and sold as a lubricating oil to railroads. This was the start of the refining industry in California which did not expand rapidly for another 10 years.

In the other Pennsylvania fields a few refiners were giving attention to the production of what they termed special products one of which they called gasoline. They had perfected cooling equipment and were recovering in a few cases the lightest ends of petroleum. A 90° Be. gravity cymogene was obtained and sold for surgical purposes and a local anaesthetic. A gasoline of 88 to 86 degrees gravity was refined and sold for air-gas machines. A 76 degree gravity naphtha was used in street naphtha lamps and another 63 to 68 degrees gravity naphtha for sponge lamps and finally a 62 degrees gravity product was in small demand as a solvent in the manufacture of varnish. Thus refiners had a small demand for the light fractions which formerly had been wasted. Later in this period a gasoline stove was perfected and this further increased the demand.

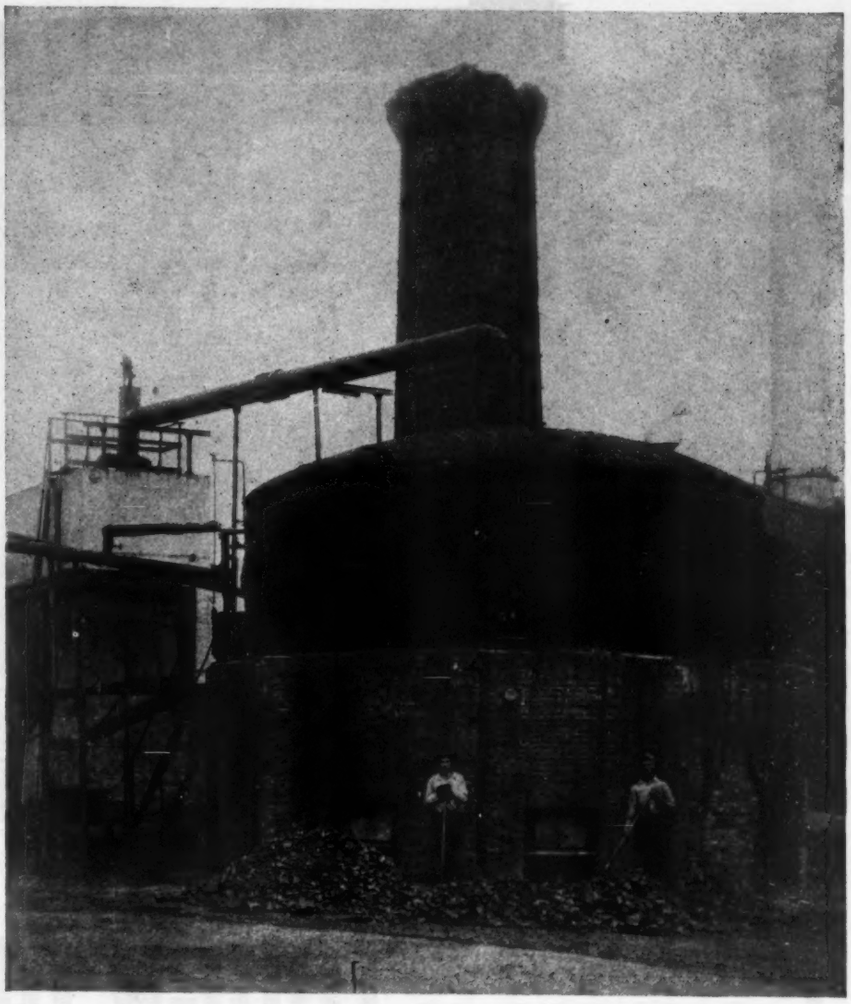
The demand for these light fractions, however, did not equal the supply and we find during this period that a stillman connected with a plant along a stream received a new suit of clothes and a new hat from his employers for his work in dumping several thousand barrels of gasoline in the river without being caught.

Burning oils were still the principal product both in the export and domestic market. Methods of testing were slowly perfected and standardized so far as kerosene was concerned and a better and more uniform product found favor with consumers and widened the market.

In the equipment end, the outstanding new feature in the early part of the period was the larger distillation units. Most of the newer refineries had one or more of the "cheese box" stills and some of these stills installed at that time were in operation in Pennsylvania until the past 5 or 10 years. These stills as indicated by their name were cylindrical in shape. A typical unit was connected by means of three vertical pipes with what was termed a "vapor chest." The latter was furnished with a large number of 3-inch discharge pipes arranged in parallel lines. The still had a dome-shaped top of iron plate and double-curved steel plate bottom. It was set over a furnace on a series of brick arches. These stills had a capacity up to 1,400 bbls.

The advantage of these stills over the smaller horizontal stills was the greater capacity, less operating labor required and claims for reduced fuel costs. The latter claim was disputed and many refiners continued to use horizontal stills of larger capacity. All these stills continued to operate on the batch basis but the larger capacity reduced the number of men required per barrel of throughput.

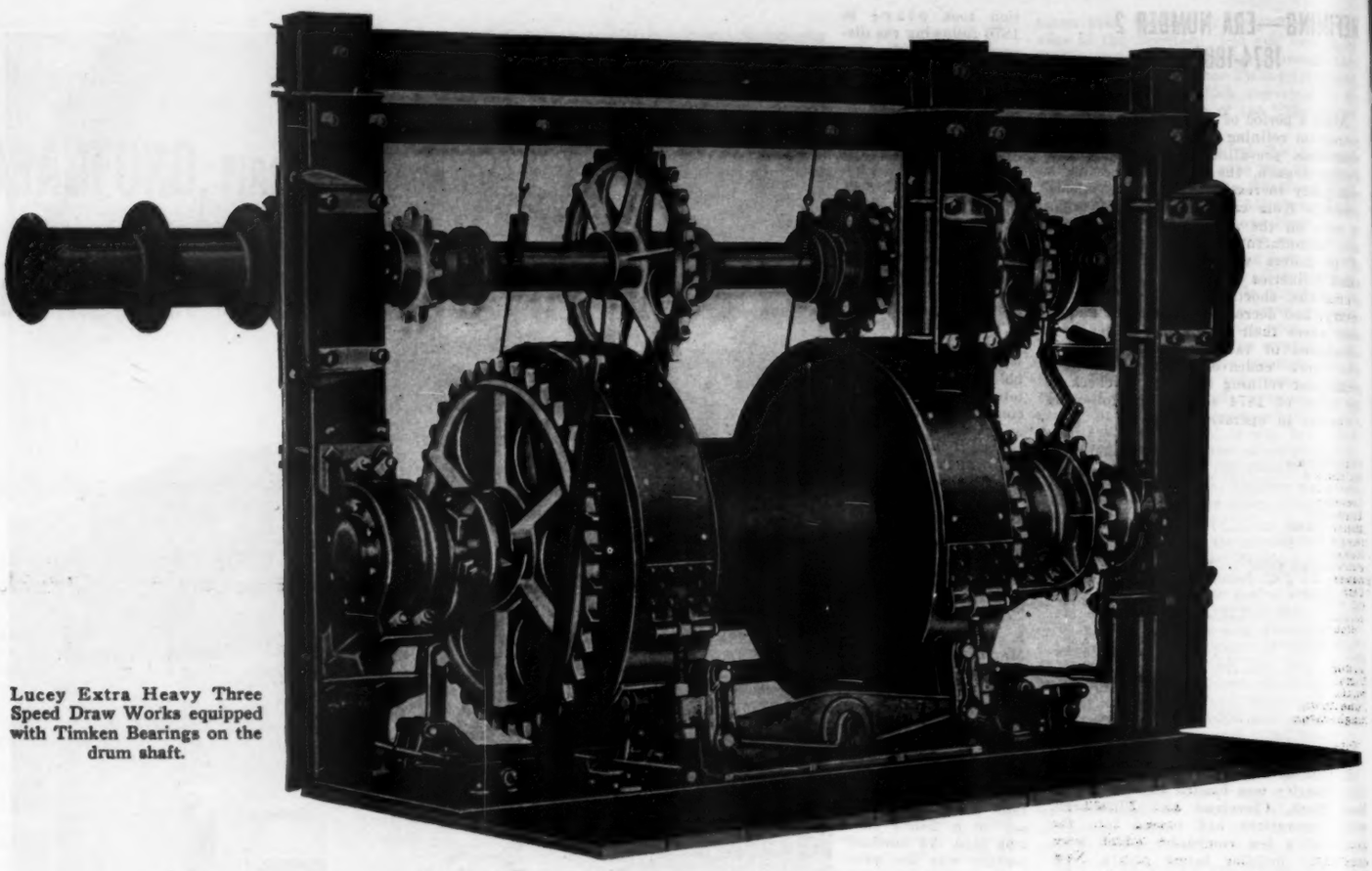
Flow charts of refineries operating in the seventies reflect the start in modern fractionating equipment. Dephlegmators or separators were often installed in the vapor line between the stills and con-



This cheese box still was in operation for more than 50 years. It was built in 1879 at the Titusville, Pa. refinery of American Oil Works. Now owned by Pennsylvania Refining Co.

REFINING INDUSTRY EXPANDED RAPIDLY IN DIFFERENT AREAS BETWEEN 1874-1889

First commercial refinery in California constructed at Newhall in 1876



Lucey Extra Heavy Three Speed Draw Works equipped with Timken Bearings on the drum shaft.

Taming TOUGH OIL FIELD JOBS

THE life of oil field machinery is just one tough job after another. Rig fronts, hoists, rotaries, swivels, pumps and all types of equipment must be tougher than the toughest job they are called upon to tackle.

Equipment manufacturers and oil field operators have found that one way to make machines tough is to equip them with a full complement of Timken Tapered Roller Bearings at all points of friction and heavy duty. Then they are as nearly wear-proof and load-proof as bearings can make them.

It will pay you to see that you get Timkens in your new equipment—the more the better.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

densers. These early fractionators, it was explained, caught the entrained liquid from the stills coming over with the vapors and prevented the heavier products going through the condensers into the tail house. This in effect meant a closer separation of products and aided in improving products. The early custom was to cover the entire stills with brick or mortar but later the practice of leaving the tops of the still open, became common. This also was a form of fractionation which coupled with partial cracking in direct fired stills in skimming operations tended to increase the output of overhead products.

During this period several refiners had advanced their operating methods to the point where they were not materially changed over a period of 15 to 25 years. This was particularly true in the Pennsylvania Field. In the light ends they were recovering several products where any market existed as previously explained. Most refiners rerun in steam stills these light fractions. By doing this they secured a closer separation of products and also simplified their treating problems. Kerosene distillates were often rerun after acid treatment and the first naphtha or benzine cuts were rerun, one product being a gasoline or high gravity naphtha and the other a kerosene cut.

While the equipment lacked many of the features installed in plants in later years refiners were following the same general practice in manufacturing neutral oils as is found today. A lubricating distillate was cut from the batch shell stills after the kerosene cut. This was cold pressed, securing a slack wax and a lubricating distillate. The wax was finished into crude paraffin and refined wax by sweating and percolation. The wax free distillate was rerun in stills to secure various grades of neutral oils. The residual in the batch was steam refined and reduced to the desired viscosity and finished into cylinder stocks with acid treatment and percolation. Animal charcoal was often used as percolating medium.

Partial vacuum was secured in the distillation of the lubricating oils through the use of steam. In fact the desirability of using steam to prevent overheating and cracking and as aid to distillation at lower temperatures was apparently known and practiced from the start of petroleum refining. However, it was not until a much later period that the use of high vacuum of 3 mm. or less absolute became general in their manufacture.

Continuous Distillation

Starting about 1885 in the United States the possibilities of continuous distillation began to receive the attention of refiners especially those who now had plants running from 3,000 to 5,000 bbls. of crude daily. The earliest major application of this operation was in Russia and it is probable that the success there was in part responsible for the adoption in the United States in several type applications. As early as 1883 the Nobel Brothers were operating stills continuously at their plants in Baku. English authorities state that the so-called Henderson continuous stills were in operation at refineries in Great Britain starting in 1885 and this innovation is listed as one of the major developments in the art of petroleum refining.

In the United States patents on continuous distillation were issued as early as 1860. In this case as in many others we find early patents covering the general principles of a process which did not secure commercial significance until years later when some individual or organization perfected the manufacturing principles and the industry has expanded to the point where there was a justification for the new operation.

In 1860, D. S. Stombs and Julius Brace of Newport, Ky., were issued a patent for a type of continuous distillation but there are no records that the patent was ever applied to a commercial refinery operation. Another continuous operation patent was issued to A. H. Tait and Joseph W. Avis of New York in 1867.

In 1877, Samuel Van Syckel actually operated a small battery on a continuous basis based on patents which he had secured. He removed naphtha from one still and burning oils from two other stills all of which were connected in series. This operation which was confined to steam distillation apparently was not continued after a few runs. The first major application of this process in the United States came near the close of the century and will be described in a later period.

Contribution of Herman Frasch

In 1885 crude oil was discovered in what later became known as the Lima Field in Ohio and this date is as important in petroleum refining as in the producing end of the business. Some writers claim that this marks the entry of the petroleum chemist in the oil business and also the start of research work which later was to play a major part in the development of the refining industry. The Lima crude oil differed in several properties from the crudes obtained in Pennsylvania, New York State, West Virginia and southeastern Ohio. What proved to be the most important difference was the presence of .75 per cent sulphur in contrast to the Pennsylvania crudes with less than .05 per cent. In the light of later events it is fortunate that the first refiners had the Pennsylvania crude with its chemical purity as their raw material. Otherwise it is certain that the rapid expansion of the industry would have been delayed until the chemists had time to perfect treating processes to secure a kerosene free of sulphur with satisfactory burning qualities.

Starting in 1886 the Solar Refining Co. (Standard) built a refinery at Lima, Ohio, to refine the new crude oil. When the illuminating oils were placed on the market there were immediate objections both on account of the odor and also the burning qualities. This problem was not solved by the Standard chemists although several treating methods were tried out.

The production increased rapidly to 30,000 bbls. daily and brought only 15 cents per barrel while Pennsylvania crude at the same time was selling from $1 to $2 per barrel. Standard executives are said to have come to the conclusion that the crude could never be used except as fuel when in 1887 or 1888 the company investigated the Frasch process. This resulted in the purchase of the Frasch refinery in Ontario and the installation of the process at Lima and other Standard plants starting in 1889.

Refinery built in early eighties in Oil City area

COAL OIL JOHNNY HAD BIG TIME ANYWAY

"Coal Oil Johnny" Steele holds undisputed title to the distinction of having been the oil industry's first spectacular spender. Adopted into the family of Culbertson McClintock, a farmer on Oil Creek near Oil City, he was 12 when his foster father died.

Oil was struck on the farm. Money rolled in. One day in 1863 Mrs. McClintock used oil to hurry a fire in the kitchen stove and was burned to death. John, then 20, came into possession of $24,500 in cash and the farm with 20 producing wells. For a little while the young man lived normally. Then he began a series of escapades which became the talk of the country. Many stories about him probably were inventions, but that he spent until he had exhausted his enormous income there is no doubt.

It is told that he ordered champagne by the basket; that he gave a $1,000 diamond pin to a negro minstrel for singing a song he liked; that he bought carriages with the horses attached when he wished to ride a few blocks; that he paid the bills for wild parties in which the ballet girls in Fox's old playhouse in Philadelphia were special guests. He was fleeced by sharpers.

Eventually the end came and he found himself poor again. He got a job as a hack driver in Philadelphia, then as baggage-master in Rouseville, Pa. About 12 years in Ashland, Neb., followed. Then he returned to Pennsylvania and settled in Sugar Creek Township, Venango County, where he died.

Delivering crude oil to one of first refineries built at Petrolia, Canada, owned at that time by the Premier Oil Co.
Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

TRANSIT

PUMPS—GAS ENGINES—COMPRESSORS

Through all these years

1880-1934

Home Office and Plant of the National Transit Pump and Machine Company at Oil City, Pennsylvania. This plant now covers fifteen acres of ground, with 450,000 square feet of floor space under roof.

TRANSIT has developed and manufactured pumping machinery almost exclusively for the oil industry—the industry it first began to serve away back in 1880.

Over fifty years ago, when the pipe lines first began using pumping machinery, a little repair shop was established at Petrolia, and another one at Tarport, Penna. About 1880, both of these shops were moved to Oil City and formed the nucleus of what is now the National Transit Pump and Machine Company. From a small shop devoted to repair work it has grown to the great manufacturing institution illustrated above.

The largest refineries and pipe lines in this country and abroad are consistent users of TRANSIT PUMPS. The same holds true in the relatively new practice of increasing oil production by water-flooding and re-pressuring by air or gas. Thus, a wealth of experience is concentrated in the products of this institution, and this experience is available to everyone.

When you are in the market for this class of machinery, avail yourself of this experience.

REFINERY PUMPS—Steam or Gas Engine Driven Hot Oil Pumps; Tar and Residuum Pumps; a pump for every refinery service.

OILFIELD PUMPS—Pipe Line, Gathering Line and Tank Pumps.

MARINE PUMPS—Cargo Oil, Fuel Oil, Bilge and Ballast Pumps.

GENERAL SERVICE—Low Pressure, Rotary, Plunger and Power Pumps.

GAS ENGINES—STEAM ENGINES—Vertical and Horizontal Gas Engines.

Gas Engine Driven Compressors.

Steam Engine Driven Compressors.

NATIONAL TRANSIT PUMP AND MACHINE CO.

OIL CITY, PENNSYLVANIA

NEW YORK - PHILADELPHIA - CLEVELAND - PITTSBURGH - LOS ANGELES - HOUSTON - TULSA

TRANSIT

A PIONEER PIPE LINE SYSTEM

Continuous Service to Oil Producers

1878-1934

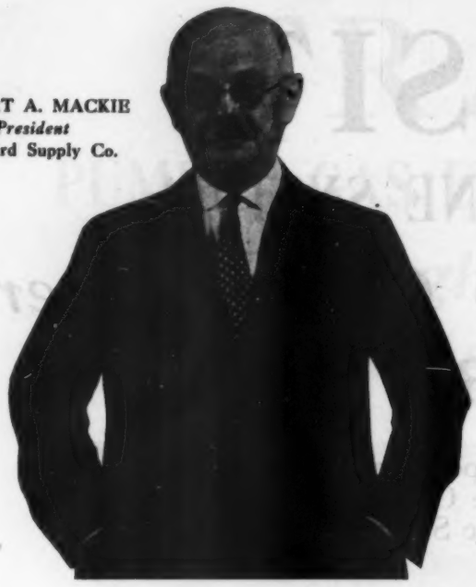
Operating Trunk and Gathering Pipe Lines under the authority granted by the Interstate Commerce Commission and the Pennsylvania Public Service Commission.

One of the immediate results of Colonel Drake's discovery was the creation of demands for particular services, none of the least of which was a method of economically transporting crude petroleum. The answer to this need was the pipe line. The first pipe line ever constructed was built soon after the oil field was opened by Drake's discovery. That line and many others formed the nucleus of a pipe line system that is still in active daily operation in this secton of Pennsylvania—the National Transit system. In 1878 many of the smaller pipe lines were brought under one head called "United Pipe Lines" and several years later these lines were taken over by the National Transit Company and became the United Pipe Lines Division. Of course, many of the pioneers who built the first lines were included in the personnel of the new division of the Transit Company. Since the early days of the oil fields in this area, millions of barrels of Pennsylvania Grade crude have been transported to market by the Transit lines, and that high type of service is still being maintained.

A history of the oil industry would not be complete without reference to the important part that the National Transit Company assumed in the building of the great network of pipe lines in the United States. By reason of its experience, the National Transit Company was called upon to build and equip most of the pipe lines that were constructed prior to 1912, when the Standard Oil Company was dissolved. These included the immense systems from the Mid-Continent fields to the Atlantic Seaboard, and the tankage gangs of Transit built the vast storage systems that were required enroute. The National Transit Company supplied the men and materials to construct the marvelous systems and "mothered" the new companies until such time as they were able to operate unto themselves. The pipe line systems of The Prairie, Indiana, Buckeye, Eureka, South West and Cumberland, as well as the lines of the Northern group, were built under the direction of Transit men and equipped with Transit material.

The National Transit Company serves today as it has served for over fifty years, and is ready day or night to aid a producer who needs transportation in order to prevent the loss of oil. Many are the romantic tales of pipe line laying by Transit that saved the day for oil producers when the wells were running wild. The last of these flush producers in this area was about twelve years ago, when the Queen sand came to life near Tidioute, and Transit men laid a line of over four miles in record time to care for the flowing oil.

NATIONAL TRANSIT CO., Oil City, Pennsylvania



ROBERT A. MACKIE
President
Bradford Supply Co.

AFTER A HALF CENTURY

IT does not seem a far cry back to the days of Sam Bayne and "Power Hall", "Morris-Tasker", "Boston" and "Allison" Tubing and Casing; F & T, Innes and Climax Steam Engines; John Eaton and E. T. Howes of the Oil Well Supply Co., with plants in Bradford and Summit City; L. Emery, Jr. & Co.—"The Big Supply Store"; Cherry Grove, Ball Town and Pit Hole.

But over half a century (54 years to be exact) has gone by since I first started serving the oil industry and I have witnessed the growth of the oil business from the confines of the Bradford and Lower Field to a world-wide industry, ranking third in value of its products.

However, the industry's course, during these years, has not been continually smooth and prosperous. There have been many reverses and disappointments. Times when producers were:

"Like one that on a lonesome road,
Doth walk in fear and dread."

But the reverses were met, the obstacles overcome and the industry steadily forged ahead.

Most of the things we worried about never happened, and judging the future by the past, the producing and refining of oil will continue on, constantly attaining greater scope and success.

It has been my aim to leave a heritage of fair and honest dealing by myself and company, and if that result has been accomplished, I am content.

R. G. Mackie

BRADFORD SUPPLY COMPANY

Established 1907—Bradford, Pa.

Fourteen Stores Located in Six States.

This solved the treating problem and from then on there was a ready market for Lima crude. It also served as a background in solving many other chemical treating problems as new crudes became available in Illinois and fields west of the Mississippi River.

Herman Frasch had first perfected his treating process with burning oil distillates obtained from Petrolia crude in Canada. Distillates from this crude which was first produced in the late sixties had a bad odor called "skunk" and retarded the sale of the products. Little was accomplished in solving the problem until Frasch in 1885 bought a refinery located at London, Ontario, and began making experiments. He determined the presence of stable sulphur compounds which were not removed in the ordinary treating application commonly used with Pennsylvania distillates. He determined that this sulphur compound dissolved a number of metallic oxides and from this fact he worked out a treating process which was economical and ended the discrimination against the "foul and worthless crude oil in Ohio."

The literature describes several applications of the process as developed by Frasch and others. Frasch described an installation at the Standard plant consisting of a large still with a flyshaft arrangement with paddles which permited the constant mixing of liquids in the still. In this still he mixed kerosene distillate with cupric oxide, using to start 5,000 pounds of oxide and 1,000 bbls. of distillate.

This charge was distilled until 80 per cent had been taken overhead. Then 5,500 pounds of additional cupric oxide were placed and distillate added to make a 1,000-bbl. charge in the still. The distillation was continued with additional oxide and distillate so that the 5,000 bbls. of distillate required approximately 30,000 pounds of cupric oxide. The residual in the still went through a filter press. The solid products from the filter press were burned free of oil. The dry mixture of oxide and sulphide of copper was finally desulphurized to less than 1 per cent in a furnace. This process was patented by Frasch in the United States in 1885.

Since 1889 various applications of this process have been developed. It attracted attention to the possibilities in desulphurization of petroleum products.

Chemists were making other investigations at this time, some of which were of no practical value before the close of the century. Asphalt was being produced through oxidation although the market was small at this time. Sludge acid was being recovered to the point where it could be reused when mixed with fresh acid. The Chesebrough Manufacturing Co., a Standard unit, perfected a product which it gave the trade name of "Vaseline." This was made from petrolatum which was residue product secured in removal of wax in the manufacture of lubricants.

Crude oil was discovered in Colorado in 1886 and the following year the United Oil Co. built a small skimming plant at Florence adjoining the field. This plant was the second to be built west of the Mississippi River, the first being in California. It later became the property of the Continental Oil Co. at that time one of the Standard units. The company is still operating the plant. The second plant in the field was built there in 1889 by the Florence Oil Co. at Florence. This plant has since been dismantled.

As this period was brought to a close in 1889 the government census report showed that there were 105 refineries in operation, representing an investment of $76,383,608. The plants refined 29,474,774 bbls. of crude oil that year or 80,000 bbls. daily. This represented an increase of approximately 70 per cent over the runs 10 years previously with a 300 per cent increase in reported investment. The value of the manufactured products in 1889 at the refineries totaled $90,835,384. The cost of the fuel oil used in refining was placed at $1,748,000 and cost of the sulphuric acid, $1,488,363. The cost of the packages in which the products were sold was $16,466,952, and the value of the crude oil consumed was $44,267,554 or an average cost of $1.50 per barrel.

Refinery of Valley Oil Co. in operation at Rouseville, Pa. in 1889. This plant site now is a part of the Pennzoil Co.'s refinery

The census report for 1880 places the total number of firms and corporations engaged in petroleum refining on May 31, 1880, at 86 and the amount of capital invested at $27,325,746. Other reports would indicate there were at least 100 refineries in operation. These firms, according to the government report, employ 9,869 people and paid out in wages during the year $4,381,572. The refineries required 17,417,455 bbls. of crude in 1880 or an average of 47,000 bbls. for the year. The refiners expended for oil and other crude materials $34,999,001 and the value of their manufactured products was $43,705,218.

Refinery built at Newhall, Calif. in 1875

First 36-inch natural gas line, planned and construction started in 1889

MANY GAS COMPANIES FORMED AND PIPE LINES EXTENDED OVER WIDE AREA DURING 1874-1889

NATURAL GAS—ERA NUMBER 2 1874-1889

The second period in the history of the natural gas industry, 1874-1889, opened auspiciously with the laying of a 6-inch pipe line from the Harvey well, Larden's mills, Butler County, Pennsylvania, 17 miles to the Spang, Chalfant & Co. iron mill at Etna, near Pittsburgh. Gas from this well had been allowed to blow into the air. In 1875 it was purchased by the Natural Gas Co., Ltd., composed of Capt. J. J. Vandergrift, John Pitcairn, Jr., and Capt. C. W. Bachelor, of Pittsburgh. When gas was turned into the line in October, 1875, it appeared that those who had said the gas was too elastic for transportation that distance were correct. Although pressure at the well was gauged at 119 pounds, the volume of gas at the Etna terminus was practically imperceptible. Undaunted, Captain Vandergrift had the line pieced at regular intervals until the investigators came upon a section in which coal miners had inserted a baffle plug. The obstruction was removed. When the well was reconnected to the line more than enough gas for the iron mill reached Etna within 20 minutes. The closing of this period found the natural gas industry at its lowest ebb, a victim of squandered resources and ruthless competition.

Dr. Chas. Oesterlin

Numerous natural gas companies were organized in this period, and toward the close, when manufacturers were seeking more reliable sources of natural gas, strong companies came to the front as the result of mergers and purchases. The U. S. Geological Survey of 1883-4 gives the following estimated value of natural gas consumed in Pittsburgh and elsewhere in 1882, 1883 and 1884. The values are based on the value of the coal that has been supplanted in furnaces using gas, in Pennsylvania, New York, Ohio and West Virginia.

Year	Pittsburgh region	Elsewhere
1882	$75,000	$140,000
1883	200,000	275,000
1884	1,100,000	360,000

Other Producing States

In 1885, Illinois was added to the list of states producing gas on a commercial scale. Indiana, Kansas and Michigan followed in 1886, and in 1887 and 1888 Illinois, Kansas and Michigan had dropped out, while Indiana became a rival of Ohio and surpassed New York and West Virginia. In 1889 the value of natural gas produced in the United States was distributed as follows: Pennsylvania, $11,593,989; Ohio, $5,215,669; Indiana, $2,075,702; New York, $530,026; Missouri, $35,657; Kansas, $15,873; California, $12,680; West Virginia, $12,000; Illinois, $10,615; Kentucky, $2,580; Texas, $1,728; Arkansas, $375; Utah, $150, and South Dakota, $25. Until the third period, 1889-1904, in the history of natural gas there was no attempt to measure production of natural gas in cubic feet, so the values shown above are merely indicative of the relative positions of the various states in reference to production. While natural gas output was declining steadily from 1888 to well into the first decade of this century, the price moved up steadily so that the value of natural gas consumed does not reflect adequately the threatened exhaustion of natural gas reserves feared in 1889.

The first gas well in the important Murrysville district, Pennsylvania, was No. 1 Haymaker, drilled to 1,600 feet on the Remalay farm, November 3, 1878. Gas allowed to blow into the air from this well until it was purchased by Pew & Emerson was estimated to represent a loss equivalent to nearly 2,000,000 tons of coal. Pew & Emerson Co., Ltd., laid a 5⅝-inch line 14 miles to Pittsburgh district from the Haymaker well and others drilled in 1882 on the Fundis farm, Westmoreland County. The line was completed in 1883. Gas fields supplying Pittsburgh on November 1, 1886, and the companies owning the pipe lines were as follows (figures denote number of wells:

Company	Murrysville	Tarentum	Hickory	Canonsburg
Philadelphia	48	10	..	..
Chartiers	7	..	16	..
Manufacturers'	..	..	..	10
Pennsylvania	..	1	..	7
Washington	..	..	5	..
People's	3	..	..	..

At this time the Philadelphia Co. operated 970,003 feet of pipe lines ranging in size from 3 inches to 30 inches; the Chartiers Company owned 116,976 feet ranging from 6-inch to 20-inch; People's owned 67,280 feet ranging from 3,-inch to 8-inch; Pennsylvania owned 34,575 feet ranging from 3 to 16-inch; Manufacturers' owned 26,530 feet of 8 and 12-inch, and Washington owned 10,300 feet of 6-inch and 8-inch pipe lines.

The first gas well drilled in the city of Pittsburgh was that of George Westinghouse, Jr., upon his own premises, between Murtland and Lang Avenues in the Twenty-first Ward. The well was 940 feet deep and produced gas at 590 feet and 868 feet as well. The well was completed May 31, 1884. There was more than enough gas available than was required to heat and light Mr. Westinghouse's home and the organization of the Philadelphia Co. was the result. He organized a company in July, 1884, which under a succession of capable executives was one day to operate 1,711 gas wells, 3,837 miles of pipe lines, 13 compressor stations, and hold under lease 251,834 acres of land outside of its Kentucky properties, serving 170,000 customers.

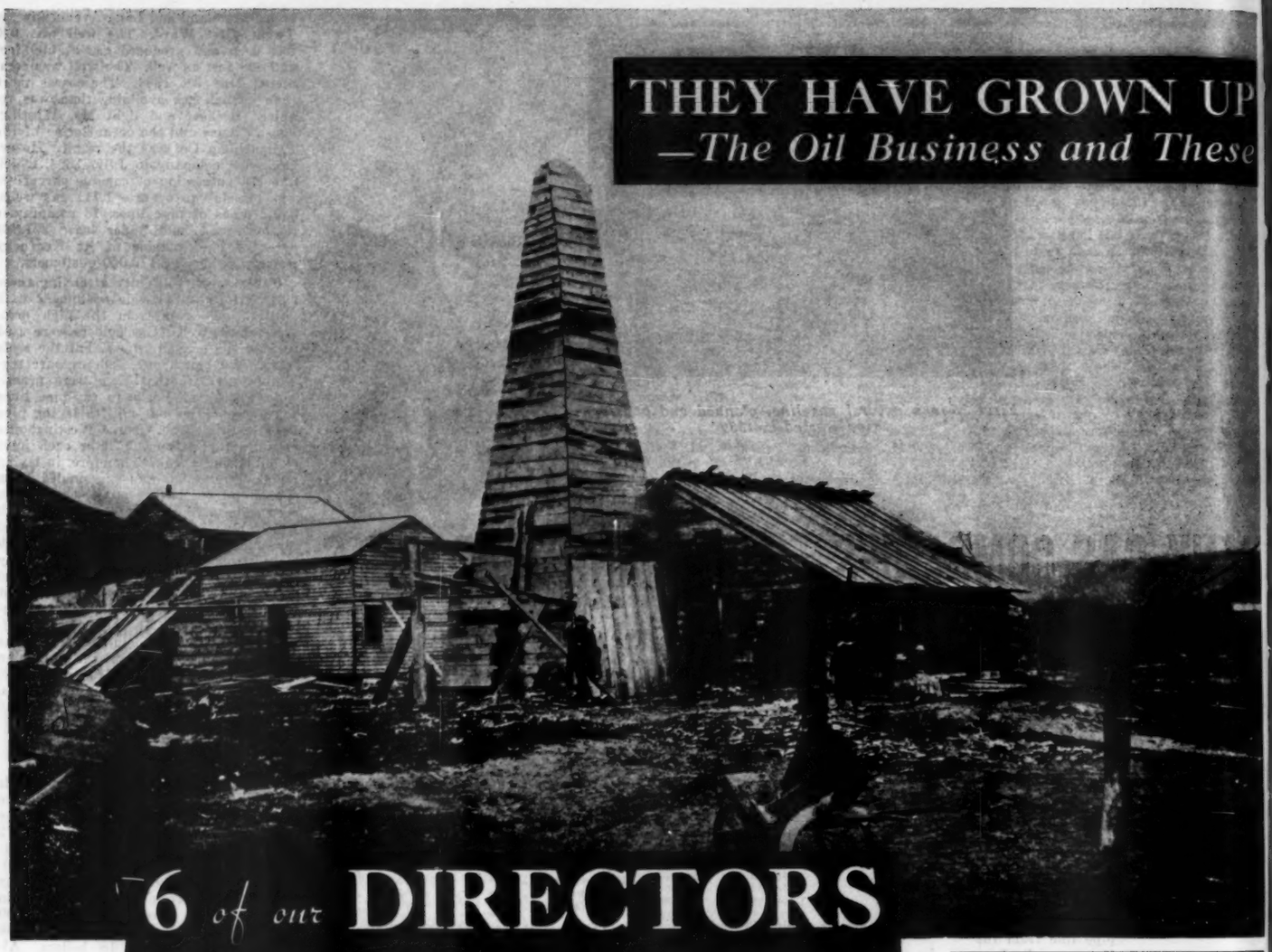
The greatest difficulty attending these early efforts to provide customers with natural gas arose from the high pressures at the wells. Gas holders were used to hold the pressure down, but the seals were often blown out, and pressure regulators used at that time were practically worthless. Leaks in gas pipe lines were accepted as normal. In laying pipe lines in Pittsburgh, George Westinghouse assumed that sooner or later each joint would spring a leak. Therefore, in laying mains, each joint was surrounded by a conical pile of broken stone, enclosed in a covering of thick tarred paper, through which rose a vertical trumpet-mouthed pipe intended to gather the gas which leaked from the joint and convey it away in a small pipe. The "escape pipe" led off at intervals of 300 feet to the nearest lamp post where it was lighted for illumination purposes. In spite of these difficulties, the Philadelphia Co., alone, was able to supply in 1885 the following number of customers: Iron and steel works, 46; glass works, 33; oil refineries, 9; various manufacturies, 101, and houses and stores, 2,637.

Field Development

Tracing the development of gas fields in this period, after Butler County, where the Fairview, Burns, Delamater, Harvey and Saxon wells came in between 1872 and 1874, came the gasser drilled at Kittanning, Armstrong County, Pennsylvania, in 1876. Gas was introduced by the Kittanuing Iron Co. in 1880, and in 1883 three wells were providing 1,000,000 feet of gas per hour to the company's 36 puddling furnaces and 18 boilers. Although the famous No. 1 Haymaker gasser was struck in 1878 in Westmoreland County, at Murrysville, the well was abandoned until 1882. In August, 1882, a well was put down near the Haymaker, and in April, 1883, a third well was drilled on Lyon's Run.

The McGuigan well, 2 miles from Hickory, began development of the natural gas industry in Washington County, Pennsylvania. This well was drilled for oil and came in as a gasser at a depth of

Well in Butler County, Pa., which supplied natural gas to Spang, Chalfant & Co. at Etna, near Pittsburgh, Pa., in 1875, through 17 miles of 6-inch pipe line.



THEY HAVE GROWN UP
—The Oil Business and These

6 *of our* DIRECTORS
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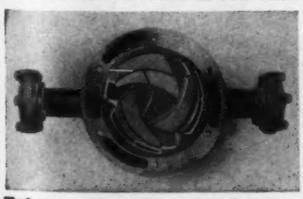
Diamond Jubilee of the Petroleum Industry, Aug. 27, 193

Laying 36-inch natural gas line between Hays Station and the Tepe Farm, South of Pittsburgh, Pa.

2,257 feet in March of 1881. In Allegheny County, the Tarentum Field was discovered by J. B. Ford, who was seeking gas for the projected Pittsburgh Plate Glass Co. factory, in 1883. Beaver County entered the gas-producing list in 1884, when two wells struck in Hopewell Township were used to supply five towns. In McKean County, where the important Bradford oil field is located, probably the greatest waste of gas occurred. A company was organized April 7, 1879, to provide Bradford with natural gas, and what was probably the first compression station was built at Rexford, 13 miles from Bradford, in 1880. The station was equipped with a Clayton duplex gas compressor connected directly to a steam engine. The gas cylinders were 24-inch diameter and the stroke was 26 inches. Daily capacity of this compressor station is reported at 5,000,000 feet, and the pressure necessary to market the gas was 50 to 60 pounds. While a pipe line 87½ miles long was built from McKean County to transport gas to Buffalo, in 1886, in that same year gas supplied to Bradford was piped from the Wilcox Pool 25 miles south.

Gas Pipe Lines

Gas was piped from the Wilcox Pool, Kane district, in McKean County, and from wells over the line in Elk County to Bradford, Salamanca, Buffalo, to the north, and east to Olean, Wellsville, and Cameron's Mills, 115 miles distant. In 1887 there were 30 wells in this district



Tobey meter, valve seat wing type

a mile and a half north of the Elk-McKean line on the west branch of the Clarion River, some of which showed a pressure of 850 pounds. At this time were recorded the important productive gas areas of Sheffield, in Warren County, and Speechley, Venango County.

The most prolific gas sand of all was struck on April 13, 1885, near McPhersons Corner, Pinegrove Township, in Venango County. This was the Speechley sand which was found to vary in thickness from 50 feet ot 100 feet, and which was first reached at 1,900 feet. Samuel Speechley was after the Bradford sand which he expected to find at 3,000 feet, estimating that the dip of that sand was at a rate of 20 feet a mile southward. When his gasser came in the Oil City Fuel Supply Co., which had been supplying Oil City with gas found at 1,000 feet at Pine Grove, laid a new 10-inch line to Oil City to augment the 6-inch line and connected branches to Titusville and Franklin. Speechley drilled a second well which showed a pressure of 600 pounds when it was finally tubed.

In Ohio, as related in this article covering the first period, gas had been found in drilling salt wells many years before the Drake well, and the gas had been utilized as early as 1838. However, it was not until Dr. Charles Oesterlin, who had said in 1838, when Daniel Foster burned natural gas in his home at Findlay, that the town was over a vast caldron of gas, succeeded in 1884 in enlisting $4,000 in capital for a deep well that Ohio really entered the list of natural gas producing states. In 1838, and again in 1864 and 1867, Doctor Oesterlin met with the scoffs of business men who talked of building artificial gas plants instead. In 1884, on November 10, Doctor Oesterlin's well reached the Trenton limestone at a depth of 1,100 feet.

Drilling began in February, 1885, in the Bowling Green Field, 24 miles north of Findlay, and the Findlay-Bowling Green gas field was established. It was not until 1886 that the real importance of this field was realized, when the Karg, 12,080,000 feet daily from 4-inch pipe; the Van Buren, 15,000,000 feet, and the Simmons, 12,422,000 feet, the latter two from 5⅝-inch casing, were completed. The Lancaster gas field was discovered in 1887, but was not to be developed until 1899. The great Trenton rock gas field, opened at Findlay in 1884, was developed until it covered about 500 square miles, but this field, with an original rock pressure of 425 pounds was to be exhausted by the time Lancaster became active. It is interesting to note that in 1866 natural gas was used in Gambier, Ohio, in the manufacture of carbon black.

Exhaustion of Findlay Pool

An insight into the early exhaustion of the great Findlay Pool is given by the following notice appearing in January, 1887:

"Findlay, Ohio, enjoys the cheapest rates for natural gas supply yet established. The city authorities entered the field and started supplying the citizens on the following basis of charges per annum: Large cooking stove, $6; heaters, $3.50 for the first, $3 for the second, and any larger number $2.10 each; lights, per pair, $1.20 a year. The old company then reduced its rates to 25 cents a month, and supplies the churches without charge."

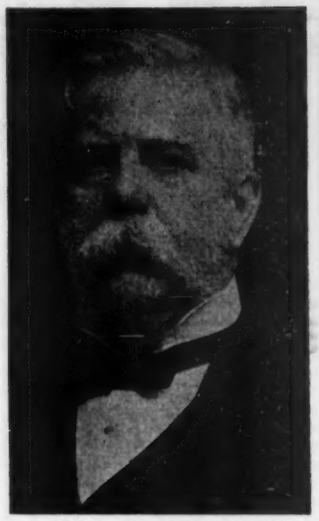
In all of the regions supplied with natural gas, from New York to Kansas, the consumers bitterly opposed the installation of meters, and in Kansas a number of people actually urged that natural gas should be free, just as the air and water. The customers got "even" with the gas companies by turning on all of the jets and opening their doors and windows, summer and winter. The gas company got little satisfaction from knowing that

In 1865, J. M. Guffey was appointed borough clerk and David Garner chief of police of Pithole.

the customers were thereby ruining their own homes and furniture. In 1888, Calvin N. Payne organized the first plant for the manufacture of gas meters on a large scale. This was the Metric Metal Co. In January of 1886, the first circular urging the elimination of waste and the use of efficient gas appliances was issued by the Philadelphia Co. of Pittsburgh. In 1890, J. N. Pew installed a compression plant in the Murrysville Field because of failing pressure.

Indiana assumed importance as a gas-producing state in 1886 and 1887. Large gas production was found at Kokomo at a depth of 908 feet in October, 1886. In 1887 there were 59 Indiana towns which had from 1 to 16 gas wells. The large wells struck in 1887 had a capacity ranging from 11,500,000 feet a day to 5,000,000 feet. Just as in Ohio, wasteful operation made itself felt before the close of the century when the original gas pressure of 325 pounds had fallen to about 50 pounds and compressors and fan blowers were called into use. As the rock pressure fell salt water killed the gas wells.

Big Moses gas well in West Virginia



GEORGE WESTINGHOUSE

First Line in Kansas

The first pipe line in Kansas was a 3½-inch pipe from a well completed in 1885 about 7 miles from Paola. In 1886 another well was brought in. Three wells were completed, two of them gassers, at Fort Scott that year. Kansas, however, just as West Virginia, Oklahoma and Indian Territory, was not to become an important gas-producing state until well into the third period of the history of natural gas. Texas, California, Louisiana, South Dakota, Colorado, Arkansas, Wyoming, Alabama, Kentucky, Tennessee, were to make their appearance in the gas list in the fourth period. Ohio and Indiana, dying fast as gas-producing states at the beginning of the third period, 1889-1904, were to revive in the fourth period, 1904-1919, for a few years.

A Pittsburgh man papered his sleeping room in 1867 with certificates of stock in oil companies. The novel wall covering originally cost him $53,000.

Stone and tablet marking site first natural gas well at Fredonia, N. Y., 1825

DRAKE WELL 1859

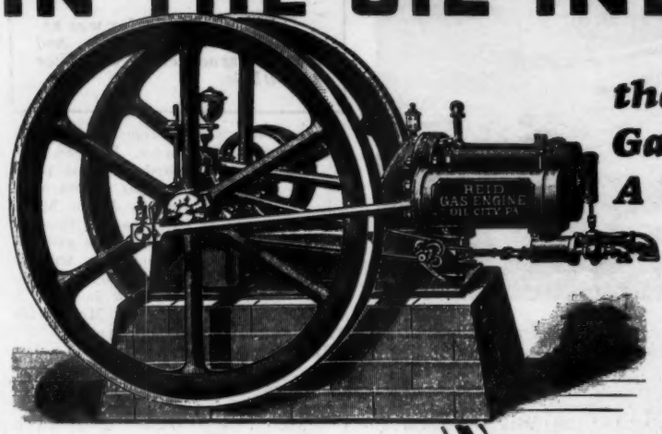
Reid GAS ENGINE 1894

Reid REVERSE CLUTCH 1899

Reid ALL METAL BANDWHEEL PUMPING POWER 1910

Reid FULL-DIESEL ENGINE 1930

PIONEERS IN THE OIL INDUSTRY



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For any oil field power requirement there is REID equipment, made for the load involved.

Put your trust in a pioneer.

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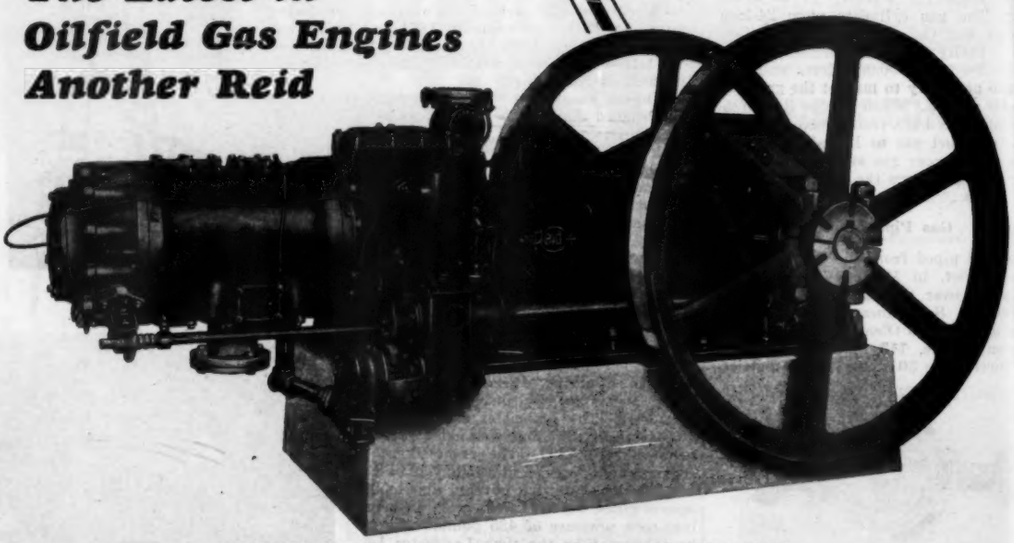

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Joseph Reid Gas Engine Company

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PERSONALITIES

W. A. Springer, who with his partner, Doctor Kennedy, opened a large field in the Osage Nation in Oklahoma and sold out for $12,000,000 to the Osage Hominy Oil Co. and the Sinclair Gulf Oil Co. in 1916, started his oil career as a pumper in 1874 in Triumph, Pa., He became a drilling contractor in the Eastern and later in the Mid-Continent Field.

W. J. Young, of Vandergrift, Young & Co., prominent producers in the second 15-year period of the oil business, really dates back to the early days of oil, having been in charge of Hanna Brothers' oil shipping business in Oil City in 1862. He later organized and was a member of a firm of oil shippers, Young & Co. The producing firm of Vandergrift, Young & Co. sold out its properties to the Forest Oil Co. of which Mr. Young was one of the incorporators and chairman.

A. C. Steele, a veteran producer in the Rixford Field in McKean County, Pennsylvania, in the late seventies started as a tool dresser and later became a driller and contractor. When the Rixford boom was over he went to other fields.

J. M. Guffey, of Guffey & Galey and the J. M. Guffey Petroleum Co. out of which grew the Gulf Oil Corp., entered the oil country in the seventies. He located at St. Petersburg and was made general agent for Gibbs & Sterrett Manufacturing Co., an oil field supply firm, the largest of its kind in the oil country at that time. Soon afterward he began operating for oil and in the second period of the industry gained a national reputation as a successful wildcatter. Guffey & Galey were among the pioneer operators in the Mid-Continent Field.

William L. Mellon, chairman of the board of the Gulf Oil Corp., made his first oil venture in 1888 near Pittsburgh, and later in the Turkeyfoot and Hookstown Pools. His first job after leaving school was a shipping clerk in the Mellon lumber yards in Pittsburgh about 1884.

Glenn T. Braden, one of the best known oil and gas men of the second and later periods of the oil industry, was first employed on the old Union Pipe Line near Millerstown, Butler County. He was district foreman for the company in the big days of the Cherry Grove excitement in 1882. He rose to be general manager of the South Penn Oil Co. and later was a leading gas man in the Mid-Continent Field with the Oklahoma Natural Gas Co.

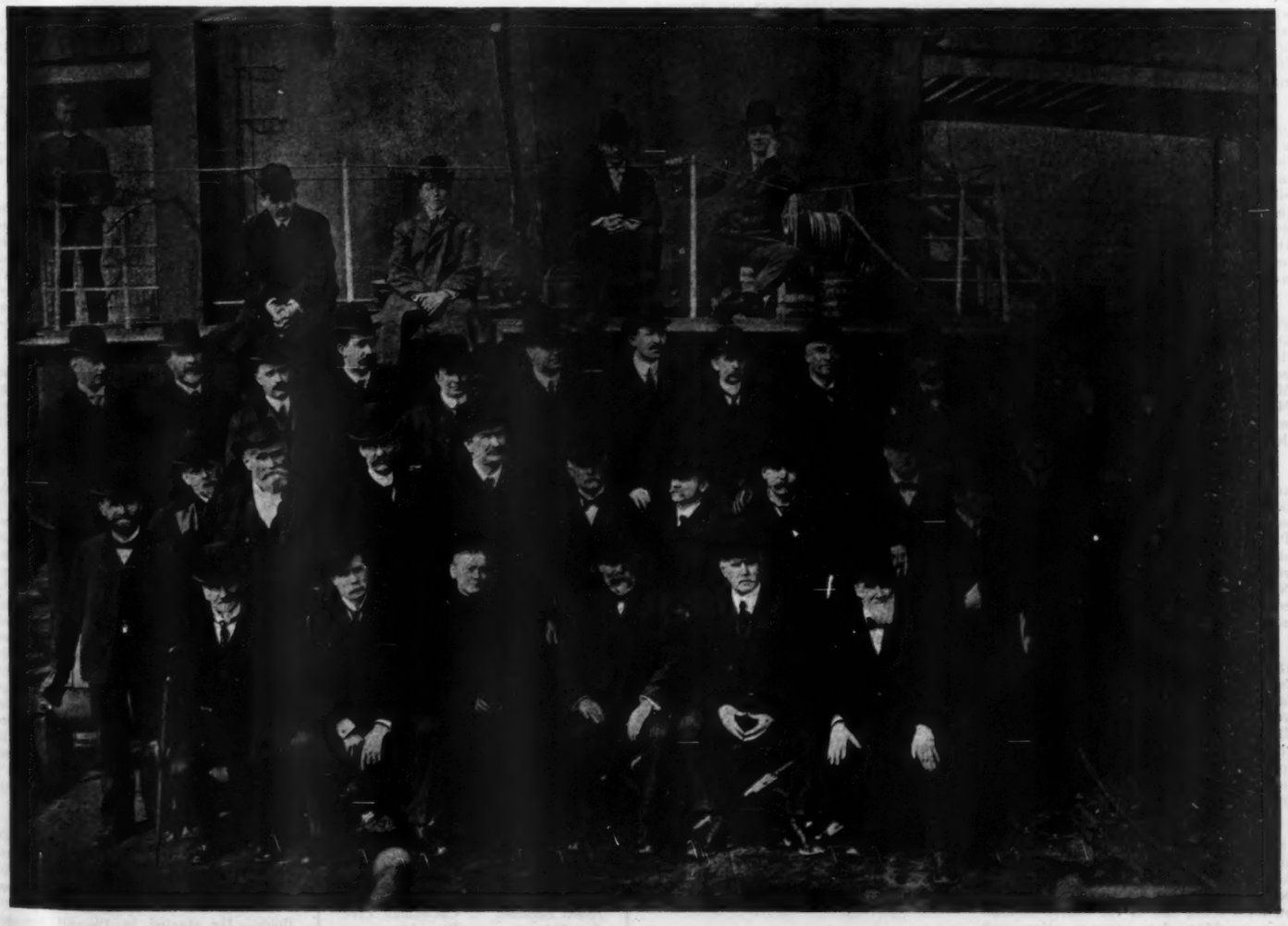
William Muir, who built and owned the Muir Oil Works in Warren in 1889 and later the Glade Oil Works, both of which were afterward merged into the Crew Levick Co., learned the marble cutting trade in Carbondale, Pa., then learned the carpenter trade and became a building contractor. He built the Hendrick refinery at Carbondale after which he moved to the oil country, where his real oil career began at Warren, Pa.

Thomas Chestnut, president of the Chestnut & Smith Corp. for many years, and one of the world's largest manufacturers of casinghead gasoline, started as a pumper in the Bradford Field in Pennsylvania in the late seventies.

Edward O. Emerson, who with J. N. Pew, drilled the then largest gas well in the world in West Virginia in 1881, the product of which was the first commercial gas to be shipped through pipe lines to Pittsburgh, was in the mercantile business in Wisconsin before going to Titusville in 1865. He went into the oil business at once but his name became best known in the second period of the oil industry. He took an active part in the Ohio and Indiana development.

Emmett Queen, who operated independently and with W. S. Guffey in the Pennsylvania fields, started as a tool dresser in the Armstrong Run Pool near Queenstown, Butler County, in the middle seventies.

James H. Snow, noted pipe line builder and general superintendent of the Standard Oil Co.'s trunk line system, made his reputation in the second period, but he



Stockholders and directors of Pure Oil Co., on board Steamer "Pennoil" at Marcus Hook, Pa., winter of 1903-04. Seated (left to right): John Galloway, Lewis Emery, Jr., Mrs. Emery, Michael Murphy, E. H. Jennings, Jos. D. Ellis. Standing (first row): Capt. Voege, J. G. Brill, M. L. Lockwood, D. E. Byles, Hon. W. F. Harrity, Peter Theobold, S. L. Burgess, Louis Walz, J. W. Lee, T. B. Westgate, R. M. Jennings, Thos. McGoey. Standing (second row): H. E. Worthington, J. B. Murphy, E. J. Quigley, Eugene Liebel, J. A. Fisher, Delevan Emery, W. W. Tarbell, Frank Tackey, Hugh King, D. A. Dennison, Clarence Walker, A. A. Hoch. On Bridge (standing): Steward of boat. Seated: N. H. Weber, Michael E. Murphy, J. A. Murphy, Fisher

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

DRAKE . . DALY . . BARR . . HASKELL . . AIKEN . . O'BRIEN . . HILLMAN . . MORAN . . DONOGHUE . . O'NEIL . . STEWART . . HARDISON . . MENTRE
SHAFFER . . GREGORY . . TILFORD . . VEIT . . PRIZER . . CROSBIE . . HARKNESS . . MOFFETT . . CRAWFORD . . RUSSELL . . ZIEGLER . . MILTON

started to work on Abbott & Harley's pipe line in 1865. He was in charge of the construction of the first pipe line to the Eastern Seaboard, from Olean, N. Y., to Saddle River, N. J., in 1880-81.

A. W. (Ab) Boyd, who operated in the Pennsylvania and Indiana Fields very successfully in the second period and later in the Mid-Continent, began life as an errand boy in a Salamanca, N. Y., hotel. When the Bradford Field opened in 1875 he was one of the first to follow up the discovery well, wildcatting successfully several miles from the first well. He explored, developed and sold many properties in his career.

Fred E. Boden was a pioneer operator in the Bradford Field and then in the West Virginia Field. The Rockland Oil Co., of which he was a part owner, was conspicuous in the Lima and Indiana fields.

Gilbert L. Watson started in the oil business in charge of the Empire Pipe Line offices in Bradford, Pa., in 1875. Later he was with the Enterprise Transit Co. Then he became a member of the firm of Bettman & Watson, one of the largest producing firms in the Pennsylvania, West Virginia, Ohio and Indiana fields, operating out of Parkersburg, W. Va.

O. P. Taylor opened the Allegany Field in New York State. In 1878 he organized the Wellsville & Alma Oil Co., largely with local capital and drilled well after well until success crowned the efforts of the plucky promoter and his backers. He died a few years after the field was opened.

George V. Forman, one of the largest producers in the Bradford Field and whose Eastern Oil Co. made oil history in later fields, was one of the big figures in the second and still later periods of oil. His son, George, succeeded him in the Mid-Continent Field as head of the Southwestern Oil Co. One of his partners, David Gunsberg, was one of the well beloved characters of both eastern and western oildom.

The Spellacy Brothers, Martin, Mike, Tim, Peter and Simon, whose names are known in many American and foreign fields, started their careers in the second period of the oil business, 1874-89. When Martin was drilling at St. Joe in 1876, Mike was his tool dresser. Later they were well known and prosperous producers in the Ohio and other fields.

J. C. McDowell, prominent oil, gas and transportation man in the second and later periods, began his oil career in the engineering department of the United Pipe Line. He was in charge of the construction of gas lines from the Wilcox gas field to Bradford, Pa., and Olean, N. Y. In later years he was prominently connected with gas, oil and pipe line companies.

William H. Zahniser, most recently of Gibson & Zahniser, and a very successful independent operator in many fields, began his oil region career as a bookkeeper for Bovaird & Seytang in the middle eighties, remaining with the firm until 1894 when he went into the oil business. He was a bold operator but his nerve was coupled with wisdom and he prospered.

John M. and David B. Crawford, of the Parkersburg Rig & Reel Co., started as clerks for Bovaird & Seyfang in Bradford in the eighties. They were bright boys who knew their way around in a business sense and in the course of time quit working for someone else and started their own business, in which they have been highly successful.

W. J. Alexander, one of the most widely known and highly esteemed pipe line managers of his time, started pipe lining in the early seventies and built up a reputation that grew better with the years and until his retirement. His service with the United Pipe Lines, the National Transit and the Eureka Pipe Line companies was conspicuous.

Alfred Cotton Bedford, chairman of the board of the Standard Oil Co. (New Jersey), went to work for the Bergen Chemical Co., a Standard subsidiary, in 1882, at the age of 22 years and later became general manager of the plant. He was made a member of the board of directors of the Standard Oil Co. in 1907, in the third period of the industry. Before entering oil, his first job was with a dry goods concern.

John Walter Leonard got his first taste of the oil business working on his father's leases in the latter part of the second period in the oil history. In later years he became widely known as an international oil man and wildcatter extraordinary in Mexico, Colombia, Ecuador and the Mid-Continent, the areas of his exploratory work in which he was very successful.

Henry S. Morton, who rose to be first vice president of the Standard Oil Co. of Indiana, began as secretary to Alexander and James Macdonald, officials of the Consolidated Tank Line Co., in Cincinnati, Ohio. He joined the Standard of Indiana in the third period, 1890, as manager of the lubricating and by-products department.

Loren J. Drake, vice president of the Standard Oil Co. of Indiana at the time of his death in 1918, started in the oil fields of Venango County as conductor on the Oil Creek Railroad. He made a study of oil transportation and marketing. He joined the Standard Oil Co. in the late seventies or early eighties and was sent to Keokuk, Iowa, in charge of oil stations in that State. In 1902 he became vice president of the Standard Oil Co. of Indiana and later president of the Standard Oil Co. of Kentucky.

Martin B. Daly, president of the East Ohio Gas Co., noted natural gas man, started life as a lease worker at Dallas City in the Bradford Field, in 1878, at the age of 18. In three years he had risen to be assistant superintendent of the Warren County Gas Fuel & Heating Co. of Warren, Pa.

James H. Barr, who rose to be president of the National Supply Co., when a boy of 16 started business life as a junior clerk in the offices of Shaw, Kendall & Co. at Toledo in 1882.

Frank Haskell, for years president and the largest individual stockholder in the Tidal Oil Co., started in the oil fields around Pleasantville, Pa., as a lease worker on his father's wells. He joined the Tide Water organization in 1908. Mr. Haskell's most notable work was in the Mid-Continent Field.

Friend Martin Aiken landed in Bradford in 1878 and opened the Aiken district in the Bradford Field and had a town named after him which became noted in the annals of oil. Later he operated successfully in the most westerly fields including the Mid-Continent.

John O'Brien, at the head of the Prairie Oil & Gas Co. in Kansas and Oklahoma, preceding James E. O'Neil, was a telegraph operator in the Bradford offices of the National Transit Co. in the eighties.

Frederick H. Hillman, who rose to be vice president of the Standard Oil Co. of California, was given a three weeks' job when a youngster as a telegraph operator in the Bradford offices of the National Transit Co. during the vacation period. As Mr. Hillman expressed it to the writer many years afterward: "My boss, Billy Splane, forgot to tell me when the three weeks were up." Mr. Hillman remained with the Standard until his death about 50 years later.

Martin Moran, for many years president of the Texas Pipe Line Co. of Oklahoma, and still a member of the directorate, began as a gauger in the Bradford Field in the eighties.

Thomas J. Donoghue, vice president of the Texas Co., began as a clerk and telegraph operator in the offices of Joseph Seep when in his teens in the late eighties. He was transferred to Corsicana, Tex., as an oil buyer where his real career began with the infant Texas Co. Mr. Donoghue can remember when he used to carry the account books of the Texas Co. to his home to work on them nights.

James E. O'Neil, for years president of the Prairie Oil & Gas Co., began his interesting career in the late eighties as a roustabout in the Titusville, Pa., district. He was district foreman for the Ohio Oil Co. at Prairie Depot, Ohio, a few years later. His upward climb was rapid. He came to the Prairie at a stormy time with the oil business harrassed by politicians, and soon smoothed the troubled waters and became the dominant oil personality in the Mid-Continent Field.

Lyman Stewart, many years president of the Union Oil Co., California, was a Pennsylvania oil man before he moved out to the coast in the early eighties. The firm of Hardison & Stewart was among the leading oil producers in the comparatively new oil region. Mr. Stewart was a Titusville product.

W. L. Hardison, partner of Lyman Stewart in the infant days in the California oil fields, had received his baptism of oil in the Pennsylvania fields and was well known in the McKean County fields before he trekked west. He helped make oil history in the Pacific Coast fields.

C. A. Mentre drilled the discovery well in Pico Canyon in California in 1875 with a spring pole outfit. Stewart & Hardison, drilling to extend the field, completed several dry holes near Newhall, and then met with success.

J. K. Dale Shaffer, prominent in the Mid-Continent in the fourth and fifth periods of oil, was the youngest member of a drilling crew on a well in Pennsylvania in 1885.

T. B. Gregory, who rose to be president of the Manufacturers Light & Heat Co., got his first job in the gas fields at Foxburg, Pa., in 1884.

Henry M. Tilford, a Kentuckian, who became a director of the Standard Oil Co. (New Jersey), began his oil experience as a clerk for the firm of J. B. Tilford & Co., later taking a clerkship with the Empire Refining Co. He joined the Standard Oil Co. in 1907.

Richard Charles Veit, who rose to a high place in the management of the Standard Oil Co., properly belongs in the first era of the business, as he started to work for the Standard as an office boy in 1868 when he was 13 years old. He made a big reputation as head of the marine department of the company.

E. B. Prizer, who became president of the Vacuum Oil Co., started his oil career as a youth in a little lubricating oil plant in Rochester, N. Y., as a city salesman. Out of this little plant the gigantic Vacuum Oil Co. grew, with Mr. Prizer as its guiding spirit.

John E. Crosbie, successful and prominent Mid-Continent oil producer and banker, started in Canada working as a tool dresser in the Petrolia Field in 1873 when he was only 16 years old. His later experiences in Sumatra, Canada, Texas, and Oklahoma, are well known.

Charles W. Harkness, a director in the Standard Oil Co., was a son of Stephen V. Harkness, one of the early Standard group. He started his oil experience as a clerk in his father's office in Cleveland in 1884.

James Andrew Moffett, Sr., a conspicuous figure in the Standard Oil Co., started in the oil business in Parkersburg, W. Va., at 18 years of age, with J. N. Camden & Co., refiners. He took an active part in the solving of problems growing out of the development of the northwestern Ohio fields with their sulphur crude. He became president of the Standard Oil Co. (Indiana) and vice president of the Standard Oil Co. of New Jersey before the dissolution.

James K. Crawford, vice president and general manager of the Oklahoma Producing & Refining Co., and a part owner of the Brothers Oil Co., began his oil region career in 1886 as a blacksmith's helper in the shops of Bovaird & Seyfang in Bradford. He made his first success as an oil producer in West Virginia in the nineties.

Charles E. Russell, pioneer operator in the Scio Pool in Ohio, was a freight brakeman in his youth. He operated successfully in the Ohio and Indiana oil fields.

H. C. Ziegler, who started life driving a team on the towpath of the old Erie and Pittsburgh Canal, and who in later life became a successful oil producer in the Venango County and other Pennsylvania fields, was one of the pioneer pipe line men and was the promoter of the Cleveland Pipe Line Co. which was designed to convey oil from the Butler County fields to Cleveland, Ohio. S. D. Karns, wealthy oil man, took a controlling interest in it and made Ziegler assistant superintendent and changed the name to the Karns Pipe Line Co. It was later merged with the United Pipe Line Co. Later Mr. Ziegler went into the natural gas business in Muncie, Ind. The National Steel Casing Plant was another of Mr. Ziegler's successful ventures. He settled in Monpelier, Ind.

Leander Milton, who is credited with having been the first oil operator to use a gas engine with which to pump wells, operated quite extensively in the Venango Field and to a less extent in the Clarion fields. He started in the oil business in 1872 by drilling a well on his father's farm in Cranberry Township, Venango County. Twenty-eight years later the well was producing as much oil as in the first year.

THEY GAVE WELLS QUEER NAMES IN THE OLD DAYS

They used to give their wells queer names in the early oil fields of Pennsylvania. Here are a few:

Johnny-Jump-Up	Big Injun
Old Misery	The Baby
Spotted Tail	Maggie
Big Medicine	Old Owl
Old Teaser	Big Potato
Little Injun	Annie
Great Leather	Christmas Tree
Big Bologna	Blue Jay
Blue Nose	Captain Jinks
Sandwich	Big Ghost
Blackhawk	Lady Hunter

Controlled Power

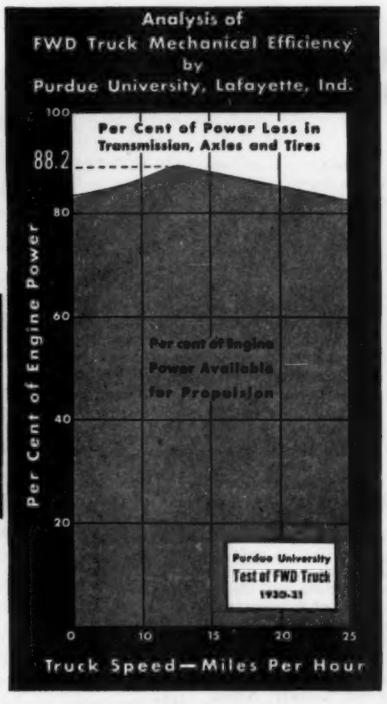
THE percentage of engine power available for useful work in a truck is its degree of mechanical efficiency. A hard-running, power-consuming truck uses much of its engine power in its driving mechanism, making it an expensive truck to operate.

A standard FWD truck tested by Purdue University was found to have a mechanical efficiency of 88.2%. Only 11.8% of the power developed by the engine was used in operating the driving mechanism of the truck. 88.2% of the engine power is available for useful work; moving or hauling loads, or in negotiating bad roads. No other similar test on record approximates this mechanical efficiency rating. The mechanical efficiency of the FWD, writes Purdue University, is "as high as ordinarily assumed for a passenger car when in good condition".

See the FWD TRUCK that was tested by Purdue University, at the Purdue University Scientific Exhibit, Travel and Transport Building, Century of Progress, Chicago

The FWD truck, which was tested for its mechanical efficiency, is now on display in the Purdue University Scientific Engineering Exhibit in the Travel and Transport Building at A Century of Progress in Chicago.

Tests prove that the FWD truck is 88.2% mechanically efficient.



FWD TRUCKS

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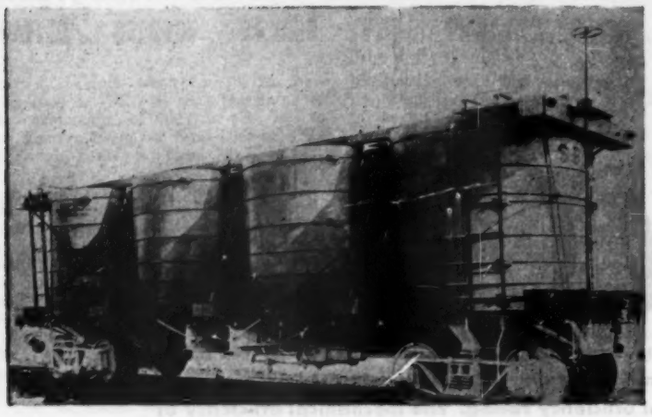
THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin
Canadian Factory: Kitchener, Ontario

- ☐ FWD Six Wheeler ☐ Use of Extreme Pressure Lubricants
- ☐ Size and Weight Restrictions of Every State in U. S.
- ☐ Report by Purdue University Regarding Efficiency Test
- ☐ Reasons for the Legal Recognition of the Six Wheel Truck.

Mr._____ Title_____

Address_____

City_____ State_____



A California tank car in use during second era

tures made the use of barrels undependable. The tins, in countries such as China, became important adjuncts to civilization in the form of stoves and cooking vessels, and what is more important, the purchase of refined oil from the Standard company brought a lamp.

It may be well to pause in this review of the widening scope of utilization of petroleum and its products, to look over some of the statistical data concerning the markets. In this second period crude oil prices were definitely down and the causes were a combination of foreign competition and overproduction at home. Average prices for a barrel of crude oil for the years 1874-1889, were as follows: 1875, $1.24¾; 1876, $2.57⅝; 1877, $2.39⅜; 1878, $1.17⅛; 1879, 85⅝ cents; 1880, 94⅛ cents; 1881, 85¼ cents; 1882, 78½ cents; 1883, $1.05⅞; 1884, 83⅝ cents; 1885, 88⅝ cents; 1886, 71⅜ cents; 1887, 60⅝ cents; 1888, 87 cents; 1889, 94⅛ cents.

Prices for refined oil per gallon in the 15 years of this second period averaged

steamers in 1878 to carry refined oil to the mouth of the Volga where the cargo was transferred to bulk barges for transportation to Tzaritzin. Sir Boverton Redwood, in 1885, presented the following figures in connection with the Russian petroleum industry:

Production and price (tons): 1873, 64,000 tons, 7s 2d; 1874, 78,000 tons, 6s 2d; 1875, 94,000 tons, 15s 6d; 1876, 194,000 tons, 7s 9d; 1877, 242,000 tons, 12s 6d; 1878, 320,000 tons, 8s 8d; 1879, 370,000 tons, 6s 3d; 1880, 420,000 tons, 3s 8d; 1881, 490,000 tons, 2s 6d; 1882, 680,000 tons, 2s 6d; 1883, 800,000 tons, and 1884, 1,130,000 tons, with the price in these two years ranging from 2s 6d down to 0s 3½d, per ton. Kerosene manufactured by the Russian refiners increased in volume as follows (tons):

In 1872, 16,400; 1873, 24,500; 1874, 23,600; 1875, 32,600; 1876, 57,100 (Nobel Brothers started production in this year); 1877, 77,600; 1878, 97,550; 1879, 110,000; 1880, 150,000; 1881, 183,000; 1882, 202,000; 1883, 206,000; 1884, 348,

ILLUMINATION AND BROADER USE FOR FUEL OIL PROVIDED MARKETS DURING 1874-1889

MARKETING—ERA NUMBER 2 1874-1889

For the purpose of proper orientation in the story of the development of the largest markets for petroleum products, a few of the important dates may be of use. These may be given as follows: The modern phase of home heating dates back to 1835, when the first central hot air furnace of the oil burning type was installed in Worcester, Mass. In 1862 Shaw and Linton patented a furnace in which oil was introduced in a gaseous state. Sparkovsky, in 1865, used a blast of hot air to atomize oil, and in the same year Ayden used superheated steam for the same purpose, in order to utilize the heavier fractions of petroleum. Another Russian, in 1870, atomized the heavy oil by introducing it into a heavy tube through which a high pressure jet of steam was directed which, by its high velocity, broke the oil into a fine spray. In cruder apparatus fuel oil had been used for several years earlier, as pointed out in the preceding section, in raising steam for railway locomotives and steam vessels. Two other dates of interest are 1883, when the hot tube ignition system was demonstrated in the Stockport gas engine, and 1884, when Thomas Urquhart perfected the method of spraying oil with steam, and when Ludwig Nobel, Carl Wittenstrom, E. Faustman and P. Ostberg, invented equipment for utilizing light naphthas in the fusion of high melting point metals.

In this second period in the history of the petroleum industry, fuel oil was found to be superior to coal as a fuel. The engines which later made the automobile and airplane possible were developed. Home and factory heating were perfected, and the list of specialty uses of petroleum products was extended. The real value of these developments, however, was not established until many years later.

Illumination in this period was still the most important field for exploitation. From the viewpoint of operators of the second period the advent of the Lucigen high candle-power spray lamp was the most important event of 1887. This lamp, memory of which is kept alive in the present blow torch, produces a flame 8 feet long, 9 inches in diameter, and was rated at 2,000 to 2,500 candlepower using 2 gallons of "mineral sperm oil" per hour. The principle of this lamp was utilized in this period in the construction of burners for steam raising and rivet heating.

Foreign Markets Keynote

Expansion of the foreign markets was the keynote of this period from the sales standpoint. It is shown that the Standard Oil Co., doing by far the largest business in the petroleum industry in the greatest oil country in the world, sold more than 40 per cent of its production abroad. The Standard company cooperage at Bayonne, in 1886, was turning out 10,000 to 12,000 oak stave barrels per day, and the company's works at Devoe registered a daily output of 60,000 tin containers of 5 gallons capacity each, and 30,000 wooden cases for the tin containers. The tins were resorted to in business with those countries of the Far East where wide variations in temperas follows: 1875, 13 cents; 1876, 19⅛ cents; 1877, 15¾ cents; 1878, 10¾ cents; 1879, 8⅛ cents; 1880, 9⅛ cents; 1881, 8 cents; 1882, 7⅜ cents; 1883, 8⅛ cents; 1884, 8¼ cents; 1885, 8⅛ cents; 1886, 7⅛ cents; 1887, 6¾ cents; 1888, 7½ cents; 1889, 7⅛ cents.

Russian Competition

The influence of Russian competition abroad upon the domestic markets in the United States cannot be overestimated. Nobel Brothers had in 1879 replaced the arbas (carts) by a pipe line to their refinery at Black Town. By 1884 there were seven pipe lines transporting Russian crude oil from the fields. In 1881 the Nobel Brothers company's first petroleum train, of 25 cars, arrived at St. Petersburg from Tzaritzin. Ludwig Nobel and Sven Almquist designed two tank

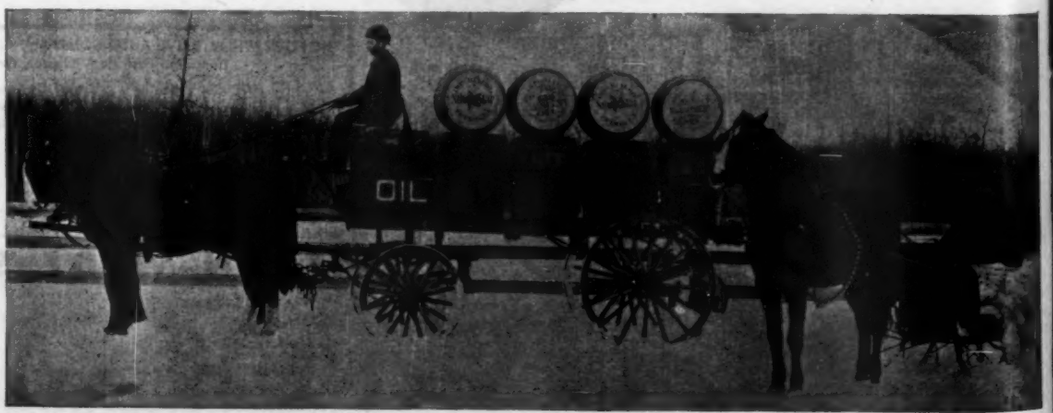
EXPORTS, 1875-1889, INCLUSIVE
(Gallons)

Year—	Crude	Light naphtha	Illuminating	Lubs	Residue
1875	14,718,114	11,758,940	191,551,922	1,173,473	1,742,848
1876	20,520,297	14,780,236	204,814,673	963,442	2,581,404
1877	26,819,202	15,140,183	262,441,344	1,601,065	3,196,620
1878	26,936,727	16,416,621	289,214,241	2,304,624	2,965,790
1879	25,274,488	15,054,361	331,586,442	2,487,681	2,207,038
1880	28,297,997	15,411,044	367,325,822	5,162,836	4,767,000
1881	39,984,844	17,292,310	332,782,045	4,852,203	3,247,860
1882	45,011,154	16,969,839	428,424,581	8,821,536	4,265,352
1883	59,018,537	17,365,314	440,150,666	10,108,394	6,502,524
1884	79,679,395	13,676,421	433,851,275	11,985,219	5,303,258
1885	81,435,609	14,739,469	445,880,518	12,978,955	5,713,903
1886	76,346,450	14,474,951	485,130,680	13,948,267	1,993,824
1887	80,450,286	12,382,213	466,242,197	20,582,413	2,880,032
1888	77,549,452	13,481,706	455,645,734	24,510,427	1,870,596
1889	85,189,458	13,984,407	551,769,666	27,903,267	1,958,458

400. Nobel Brothers in 1876 produced 100 tons of kerosene, and in 1884 their production had risen to 157,100 tons for the year as compared with 191,000 tons output of all other refiners in Russia. In 1885 Russian kerosene was offered in Europe and the Levant at a price considerably under cost of transportation in order to push out the American product which gave better illumination. American refiners found the Russians imitating their packages and even their brands. In Germany in 1885, the Nobel Brothers sold kerosene 15 to 20 pfennigs below the American price in order to introduce their product. In 1886 (November), John D. Jamieson wrote on this competitive situation in the Pall Mall Gazette as follows:

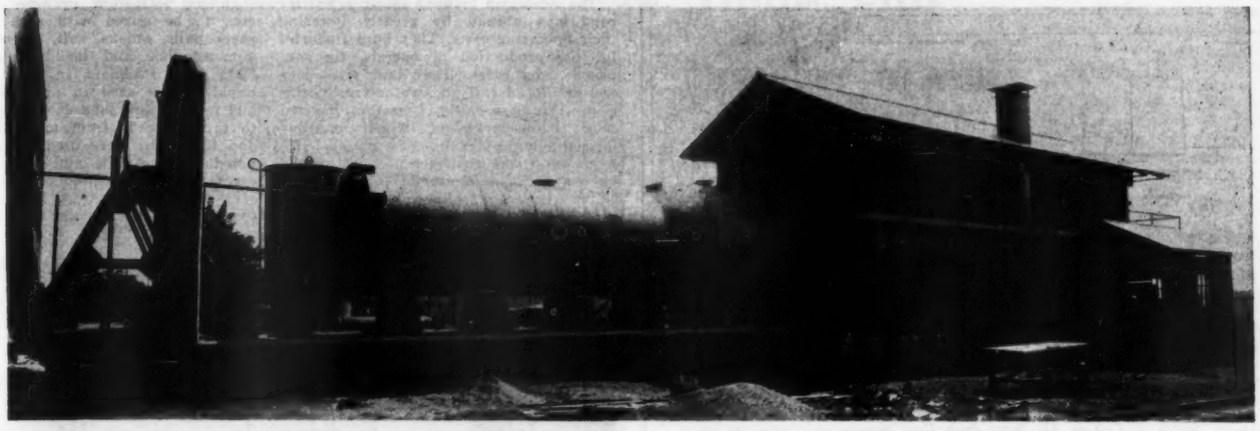
> *The first oil from Drake's well sold for about a dollar a gallon.*
>
> *The first discoveries of oil in Pennsylvania, near large deposits of bituminous coal intensified the erroneous belief that coal was the source, hence "coal oil."*

"The United States commands the available markets of the world with an organization backed up with immense resources, economic, complete, perfect, the power of which the Russian industry now

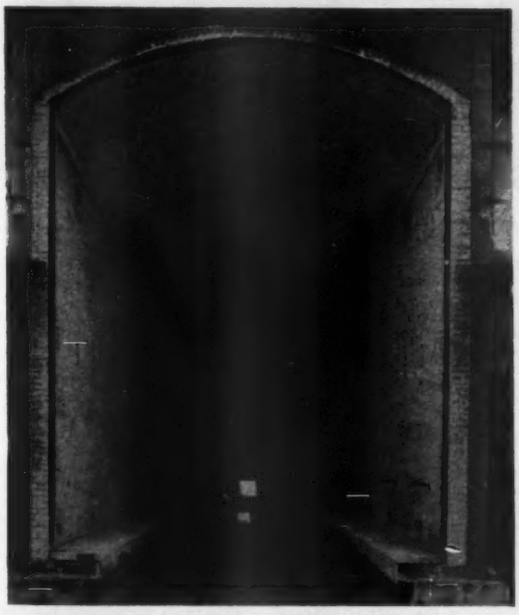


Early delivery equipment of Imperial Oil, Ltd., in Canada

PROGRESS!



View of Car-Type Annealing Oven, showing large vacuum fractionating tower, and a forged and machined high-pressure expansion joint being loaded into oven prior to annealing. Notice control pyrometer room at extreme right. A multiplicity of controls assure uniform temperatures throughout the oven with a variation of + or — 15°F.



Interior of Annealing Oven. It is 14′ wide x 15′ high x 54′ long, inside dimensions.

Portable Industrial Radiographing Unit for examining welds of Unfired Pressure Vessels.

Exterior view of Annealing Oven a few minutes after above picture was taken with tower inside, door closed, and burners ready to light. Vessels up to 54′ in length can be handled in one heat while vessels up to 100′ in length can be handled in two heats. The car is made in two sections and when vessels under 26′ in length are to be annealed, only the rear car is used so that only half the oven has to be heated; thus making it possible to economically anneal small vessels.

OUR facilities for stress-relieving and X-raying Unfired Pressure Vessels, as pictured on this page, combined with the fabricating facilities of our modernly equipped shops, place us in position to supply A.P.I.-A.S.M.E. Code Vessels as required by the latest developments in the Petroleum Industry. All of our vessels are inspected and stamped by inspectors of the Hartford Steam Boiler Inspection and Insurance Company, or, if required, all of our vessels are inspected and stamped by other qualified inspectors.

We can furnish unfired pressure vessels in any sizes within transportation limits. The Devine shops are tooled to cold-roll plates 240 inches wide and in excess of 2 inches thick while plates over 4 inches thick can be hot-rolled, thus placing us in position to fabricate, anneal, and X-ray steel and alloy steel unfired pressure vessels in exact accordance with your requirements and specifications.

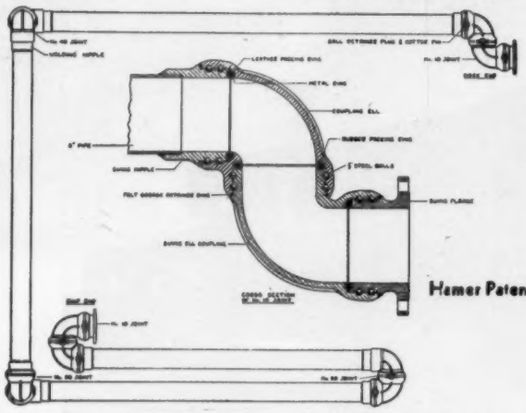
Your inquiries on Code Vessels and vessels of all kinds are solicited.

J. P. DEVINE MFG. CO., INC.

Subsidiary of Mt. Vernon Car Mfg. Co.

MOUNT VERNON, ILL.

CHIKSAN all-steel HOSE
for
DOCKS and LOADING RACKS



Diagrammatic Sketch of Chiksan All Metal Dock Hose showing cross-section of No. 10 Joint (Double Ball Race).

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Eliminates fire hazard.
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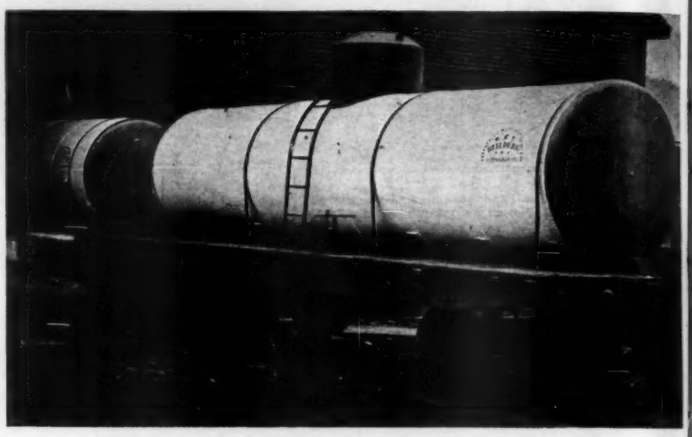
knows to its cost. In 1876 the United States refiners sold their oil at 33 cents per gallon; recently their price has been 6⅝ cents per gallon, barrels included, and yet the American companies pay good dividends, and the shares for the greater part command high premiums."

American Methods

The American refiners met competitive conditions abroad by greatly lowering their operating costs. They built factories for the production of barrels, tin containers and cases. They laid pipe lines and developed rail and water transportation. The more alert operators utilized their by-products, of which gasoline formed a large portion. As early as 1870, a company had been incorporated for the purpose of manufacturing oil gas machines (using gasoline), storage tanks for gasoline and metal barrels. This was the Gilbert & Barker Co., which became a subsidiary of Standard Oil Co., in 1884, through its purchase by Pratt Manufacturing Co. It is interesting to note that in 1910 this company began to manufacture a complete line of measuring pumps and storage tanks for handling gasoline and lubricating oils.

Returning to the utilization of petroleum and its products, happenings and developments of interest in this period included the following: In 1873 it is stated in the proceedings of the American Pharmaceutical Association, that gasoline is used as a solvent for certain oleo resins and in the preparation of atropine, santonine, veratrine, delphine, strychnine, brucine, cantharadine, quinine, cinchonine, narcotine, aconitine and coumarine. In 1875 Morgan and Brown patented a process for solidifying petroleum with decoction of bark of Quillaia Saponaria. In 1879 "benzine soap" was introduced by M. M. Barbieux Rosier, Marseilles, who added, "a certain quantity of concrete fatty matter of either animal or vegetable origin to petroleum naphtha and saponified with ordinary alkaline lye." In 1880, petrolatum was recognized as an official preparation of the U. S. Pharmacopoeia under the name of Unguentum Paraffini.

The U. S. Patent Office, in 1883, issued scores of patents on receipts for making kerosene safe in lamps. The formulas called for use of ingredients such as potassium cyanide, curcouma, etc., to be mixed with such things as rusty nails, onions, salt, essence of tar, gum camphor, and the like, and sold for $2 a copy. Peckham, in 1885, said that naphtha was used in air thermometers and for cleaning guns. Kerosene was used to protect seeds from mice, birds, etc., and light lubs were used in clocks. He noted that graphite and lead soap mixtures were being produced as superior grease components, and that powdered pyrophyllite, resembling talc, was suggested. Paraffin wax was in great demand as chewing gum. In 1887 rhigolene was stated by F. E. Ives to be better than sulphuric ether in the production of "lime light," and at 30 cents a pound cost half the price of the ether. In 1888



Refined oil tank car at Titusville, Pa., used in the eighties

The first oil-boom town in America was Pithole, Penna., near Titusville which started January 7, 1865 when the Fraser well produced 650 barrels a day. Its population variously estimated from 8,000 to 20,000 declined to two families in less than ten years.

Priestman introduced his kerosene burning internal combustion engine. The exhaust heat volatilized the fuel, and ignition was by electric spark. James Riley, in Scotland, introduced apparatus for burning liquid fuel in a regenerative furnace in a steel mill, in 1888.

Tank wagon of early days
Diamond Jubilee of the Petroleum Industry, Aug. 27, 19

KEROSENE LINE AND START OF OKLAHOMA AND TEXAS SYSTEMS MARKED THIRD ERA

Pipe line suspended by cables from cliff in Ventura County, Calif.
Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

TRANSPORTATION—ERA NUMBER 3
1889-1904

Of outstanding importance in the third era of transportation are the construction and successful operation of a twin pipe line carrying crude oil and kerosene long distances and over mountains, from refineries and oil fields in northwestern Pennsylvania, including Oil City, Franklin, Titusville, Bradford and Warren to the Atlantic seaboard at Marcus Hook, Pa., and the beginning of pipe line construction in the Mid-Continent and Texas coastal areas. Although kerosene had been pumped through a pipe line from an Oil City refinery to a railroad terminal less than 1 mile away as early as 1864, the first important movement of refined oil by pipe line was not recorded until June 24, 1893, when kerosene was pumped through a 252-mile pipe line extending from the Pennsylvania oil region to Wilkes-Barre, Pa. Later in this era this line was extended to the seaboard at Marcus Hook, Pa.

The idea of transporting kerosene by pipe line originated with Lewis Emery, Jr., of Bradford, Pa., in 1891. Mr. Emery made plans for the construction of a twin pipe line, one line for crude and one for refined oil. The announcement of his intention to build these lines was looked upon as a joke and created considerable merriment and ridicule. However, in 1892 Mr. Emery organized the United States Pipe Line Co., secured a right of way and started active construction of the two parallel pipe lines the same year. His object was to build the lines to the eastern seaboard.

Deliveries at Wilkes-Barre

In June, 1893, crude oil was being delivered at Wilkes-Barre, Pa., through a 4-inch line, starting at Bradford, Pa., 175 miles west and refined oil was also going into Wilkes-Barre throughout 252 miles of line, connecting with the independent refineries in the towns mentioned above. The first plan was to run the parallel lines from Bradford to Williamsport, Pa., to the Reading Railroad. This plan did not materialize and it was then decided to veer to the New York, Ontario & Western Railroad station near Hancock, N. Y., where the work was again stopped at the Erie Railroad track. Mr. Emery then pretended to make a stand until the courts should decide whether or not the pipe could be laid under the Erie tracks and the opposing camps faced each other for three months. Meanwhile Mr. Emery obtained the right of way to Wilkes-Barre on the friendly Jersey Central Railroad.

In 1896 another attempt was made to reach tidewater at Constable Hook, N. J., and notwithstanding the violent opposition of rival corporations, both pipe lines and telegraph lines were built to Hampton Junction, N. J., 40 miles west of the seaboard. Tanks and loading racks were erected here for handling both crude and refined oil pumped from Wilkes-Barre. Near this point the company was held up by an injunction served on it to remove its pipes from under the D. L. & W. Railroad tracks. For about 18 months, oil was loaded into tank cars at Hampton Junction while the matter was being tried in the courts. Several pitched battles were fought between the railroad company and pipe line company men. After going through the lower and higher courts, the pipe line company was obliged to remove its pipe line from under the D. L. & W. tracks.

The pipe line company then abandoned the idea of getting to the seaboard through New Jersey and while Hampton Junction was only 12 miles over the Jersey line, it was necessary to come back into Pennsylvania 10 miles further to Wind Gap, from which point another right of way had been secured in the direction of Philadelphia. These 22 miles of double line taken up were relaid between Wind Gap and Freemansburg, Pa., where the lines once more connected with the Central Railroad of New Jersey, 75 miles west of Constable Hook.

Marcus Hook, Pa., had now been decided upon as the tidewater outlet and in 1901 the work of closing the gap of 64 miles east of Freemansburg was begun and the enterprise was successfully consummated in the spring of 1902.

Carried Different Oils

For one year the company transported standard white oil successfully. Then it tried the experiment of piping water white oil through the same line. This also proved a success with a mixture of only about one-half of 1 per cent between the high and low grades. For 30 years the United States Pipe Line Co. continued pumping water white, standard white and prime white oils, all different tests and colors, and in that period it is reported it never had a barrel rejected at seaboard.

While further developments of this pipe line properly belong to later eras of the history of transportation, for the convenience of the reader, the remaining record of the United States Pipe Line Co. will be included here.

About 1910, the company cleaned its crude oil line from Titusville to Marcus Hook, and used this line for refined oils, giving the company a line for water white and a separate line for standard white oil. The sizes of the United States pipe lines were 4, 5 and 6-inch diameters, and they delivered to tidewater an average of about 3,600 bbls. a day.

At the outbreak of the war, the markets for refined oil, in Europe, reached such a low point that the distillate oils formerly used in the manufacture of refined oils were used in the new process cracking plants, and made into gasoline. There were 22 refineries connected to the United States Pipe Line, at Franklin, Oil City, Titusville, Warren, Bradford, Olean and Wellsville.

In 1923, as there was no longer sufficient business to keep this line going, it was decided to abandon the idea of transporting refined oils, and about 550 miles of United States pipe lines were taken up and sold. This line was built of wrought iron pipe, and after 32½ years of service the condition of this pipe was remarkable, most of it being reported as being as good as the day it was put in the ground.

Mid-Continent Trunk Line

Pipe line construction in the Mid-Continent area began in 1903. Development of the oil fields in this large territory resulted in the very extensive and rapid construction of pipe line facilities by a number of companies.

The first pipe line to be constructed in the Mid-Continent was by the Prairie Oil & Gas Co. when, in 1903, it built a 6-inch pipe line, 32 miles long, to connect the Chanute and Humboldt Pools in Kansas with the refinery of the Standard Oil Co. of Kansas, located at Neodesha, Kans. This was the beginning of the trunk pipe line system of the Prairie which ultimately reached a total of more than 13,250 miles of trunk and gathering lines with pump stations of very large capacity, the one at Redel, Kans., having a capacity of approximately 200,000 bbls. per day.

After the completion of the line from Chanute to Neodesha, pipe was strung by the Prairie through the northern part of Oklahoma, preparatory to the construction of a line to serve the Bartlesville and adjacent fields. Consternation was caused by the announcement of the Secretary of the Interior that before pipe could be laid through Indian country a special act of Congress would be neces-

sary. The pipe was picked up and stored.

Application then was made to the Secretary of the Interior for permission to lay a pipe line from the Bartlesville Field in Oklahoma to Caney, Kans., on the line between the two states. The matter was presented to Congress, and in 1904, by a special act of Congress, the Secretary of the Interior was authorized to permit the Prairie company to build a line. Prior to this oil purchased by the Prairie in the Bartlesville Field was shipped by tank car to Caney. This short haul had been very expensive. In December, 1904, the Bartlesville 6-inch line was placed in service, the first trunk pipe line in the State of Oklahoma.

To keep pace with the rapidly increasing production, the Prairie Oil & Gas Co., from 1903 to 1905, built different 6-inch lines, which gave a continuous line, 134.81 miles in length, from Red Fork, near Tulsa, to Humboldt, Kans. A 4-inch line, which joined this 6-inch line, was also laid from near Cleveland, Okla. In 1904, an 8-inch line, 113.33 miles in length, was laid from Humboldt pumping station to the Sugar Creek refinery of the Standard Oil Co. of Indiana, which is located near Kansas City, Mo. During the same year an 8-inch line, 28.30 miles long, was built from Argo pumping station to Humboldt station.

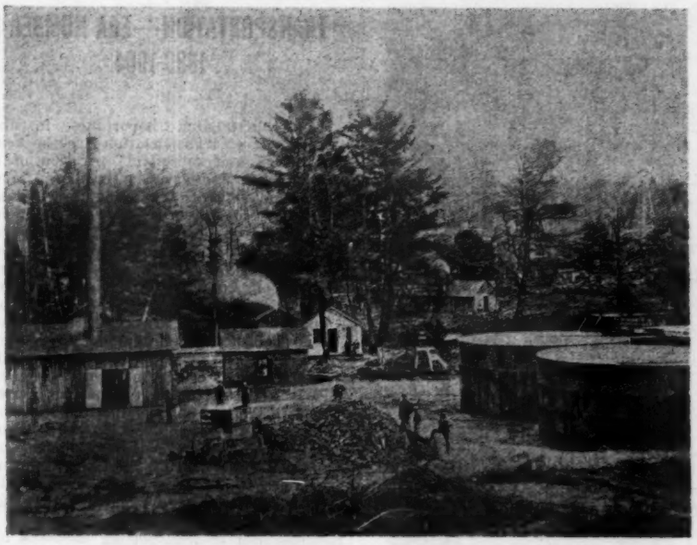
The W. L. Mellon Pipe Line, known as the Craig-Mellon Line, was organized in 1892, and began laying a pipe line from its pump station and storage tanks at Hays Station (near Greggs), Allegheny County, Pennsylvania, to the McCurdy, Oakdale and McDonald, Pa., oil field. In the spring of 1893 the Mellon line began building storage tanks and a pump station on the Wells Flats at Sistersville, W. Va., and a 5-inch line was laid from Sistersville to Hays Station, Pa., and in 1893 it built the Crescent Pipe Line, a 5-inch trunk line, from Hays Station to Philadelphia, Pa. In 1895 the Mellon Pipe Line sold its entire interest in pipe lines to the National Transit Co. (Standard Oil Co.).

Pipe Lines in 1893

The pipe lines in 1893 were: The National Transit Co., United Pipe Lines Division, 6 and 8-inch trunk lines from Bear Creek, Pa., to Olean, N. Y.; Bear Creek, Armstrong County, Pennsylvania, to Crown, Clarion County, Pennsylvania, 28 miles; Crown to Kane, McKean County, Pennsylvania, 35 miles; Kane to Colegrove, McKean County, Pennsylvania, 30 miles; Colegrove to Olean, N. Y., 30 miles, and Kane direct line to Olean, 35 miles.

The Buffalo line was about 56 miles long, having its initial point at Olean, N. Y. It was 4-inch pipe. The New York line consisted of two 6-inch pipes starting at Olean, N. Y., and running parallel to each other through the southern counties of New York State to Saddle River, N. J., where the lines separated; one going down to the refineries at Bayonne, N. J., and the other going under the North and East Rivers to the refineries at Hunter's Point, on Long Island. In addition to the two parallel 6-inch lines, the New York line was looped at many of the stations, thus making the total length of pipe used 762 miles, the distance traversed by the line being 313 miles.

The Tide Water line of 6-inch pipe, extended from Rixford in McKean County to Coryville, and to the refinery of the Tide Water Oil Co., Ltd., at Bayonne, N. J., a distance of 284 miles.



First pump station located at National wells, near Pleasantville, Pa.

The Southern Trunk line started from Morgantown, W. Va., and extended to Philadelphia, a distance of 274 miles. This line was composed of 6 and 8-inch pipe, the total length of pipe being about 364 miles.

The accompanying table shows the actual length of each trunk line. In addition to these there were many other large lines connecting the various systems and different oil fields. For example: Between Kane and Bear Creek, a distance of 63 miles, there were five 6-inch lines; from Kane to Colegrove, there were 22 miles of 8-inch pipe, and from Colegrove to Olean, 30 miles of 8-inch pipe. The total pipe, including these large connecting lines and the double lines and loops, amounted to 3,000 miles.

Pipe Lines at Spindletop

While the first trunk pipe line in the Mid-Continent area was laid in 1903 by the Prairie, the J. S. Cullinan Pipe Line Co. constructed a short line from the field east of Corsicana, Tex., to loading racks on the railroad at Corsicana. The personnel of the Cullinan Pipe Line was J. S. Cullinan, president and general manager; W. T. Cushing, superintendent of the pipe line; Lee R. Brown, later chairman of the board of the Magnolia Petroleum Co., superintendent of refineries.

With the opening of the Spindletop Pool, 3 miles from Beaumont, Tex., in January, 1901, the need for pipe lines was urgent. Guffey & Galey were said to have appealed to the Standard Oil Co. to take the oil. A party of Standard Oil officials, headed by Daniel O'Day, president of the National Transit Co. and subsidiary companies, and C. N. Payne, general manager, accompanied by J. S. Cullinan and the late P. C. Boyle, then publisher of the Oil City Derrick and later of The Oil and Gas Journal, visited Spindletop and viewed the field. It is reported Mr. O'Day remarked: "Too big, too big; more oil here than will supply the world for the next century—not for us," and the party departed.

J. M. Guffey then turned to the Mellon Brothers of Pittsburgh. The Mellons furnished capital to lay a line from Spindletop to the tidewater at Port Arthur, 20 miles south. The line was started in March, 1902, and completed shortly afterward. Other lines followed to Sabine Pass on the Gulf of Mexico.

The Pews, who control the Sun Oil Co., laid the Sun pipe line; the National Oil & Pipe Line Co., with Underwood Nazro, now of the Gulf companies, as manager, followed as did the Burt Refinery Co.'s line. The latter eventually became part of the Magnolia Petroleum Co.'s properties.

When the Standard Oil Co. officials turned thumbs down on Spindletop, Mr. Cullinan interested John W. Gates, and with his financial support, a line was laid to Port Arthur with gathering lines in Spindletop. Later the present Texas Co. was organized with Mr. Cullinan as president.

Thus two of the largest pipe line companies in the country, the Gulf and the Texas Co., originated during the boom at Spindletop.

LINES AND MILEAGE IN 1893

	Miles
Pittsburgh Pipe Line, 4-inch pipe:	
Bear Creek to Pittsburgh	55
Buffalo Line, 4-inch pipe:	
Olean to Buffalo	56.34
Cleveland Pipe Line, 6-inch pipe:	
Bear Creek to Simpson	29.81
Simpson to Warren	30.33
Warren to Mantua	22.16
Mantua to Cleveland	28.69
	110.79
Philadelphia Pipe Line, 6-inch pipe:	
Colegrove to Hunt's Run	23.41
Hunt's Run to North Point	25.90
North Point to Pine	25.72
Pine to Latshaw	45.40
Latshaw to Millway	51.94
Millway to Philadelphia	62.50
	234.85
Baltimore Pipe Line, 6-inch pipe:	
Millway to Baltimore	65.80
New York Pipe Line, 6-inch pipe:	
Olean to Wellsville	28.64
Wellsville to Cameron Mills	27.93
Cameron Mills to West Junction	29.74
West Junction to Catatonk	27.37
Catatonk to Osborne Hollow	27.99
Osborne Hollow to Hancock	29.86
Hancock to Cochecton	26.22
Cochecton to Swartwont	28.94
Swartwont to Newfoundland	29.00
Newfoundland to Saddle River	28.71
Saddle River to Bayonne, N. J.	16.39
Saddle River to Hunter's Point, N. Y.	12.26
	762.01
Tide Water Pipe Line, 6-inch pipe:	
Rixford to Olmstead	28.7
Olmstead to County Line	36.0
County Line to Muncy	53.5
Muncy to Shuman	33.9
Shuman to Hudsondale	27.61
Hudsondale to Changewater	53.5
Changewater to Bayonne, N. J.	51.5
	283.75
Southern Pipe Line, 8 and 6-inch pipe:	
Morgantown to Watson	33.82
Watson to State Line	35.52
State Line to Knepper	66.67
Knepper to Millway	75.42
Millway to Philadelphia	62.50
Total (with loopings)	364 32
Crescent Pipe Line (Mellon Line), 6-inch pipe:	
Greggs to Milbank	about 48
Milbank to Ingleside	about 24
Ingleside to Saxton	about 30
Saxton to Mount Holly	about 55
Mount Holly to Florinal	about 40
Florinal to Linwood	about 60
	347
United States Pipe Line (Emery Line), double line, 4 and 6-inch pipe:	
Titusville to Tarport	about 65
Tarport to Westfield	about 60
Westport to Athens	about 55
Total (two lines)	380

Extensions in Central West

Numerous pipe line companies were formed and an extensive system of transportation developed to take care of the production developed in this era in the Central West fields. A resume of the pipe line situation at the end of 1904 follows:

Eighty-seven thousand producing oil wells were connected with the Standard

Pipe line crew laying first trunk pipe line in Illinois

Oil Co.'s pipe lines and 5,000 with the Independent pipe lines.

The trunk pipe lines from the oil fields to the seaboard at that time were:

The Cumberland (Kentucky) pipe line, from Olympus, Tenn., to Braden Station, Tyler County, West Virginia. The route and size of line and location of pump stations were as follows: First pump station at Olympus, Pickett County, Tennessee; 60 miles of 2, 4 and 5-inch pipe line to Somerset Station, Pulaski County, Kentucky; 40 miles of 5-inch pipe line from Somerset to Winchester intersecting station with 3-inch branch line, 17 miles in length, from Barboursville, Knox County, Kentucky, to Winchester Station, Perry County, Kentucky; Winchester Station to Licking Run, Magoffin County, Kentucky; 68 miles, 5-inch line, intersects with 4-inch branch line, 41 miles in length from Ragland, Bath County to Licking Run, Magoffin County, Kentucky; Beaver Creek, Floyd County, Kentucky, station, 3-inch 40 miles in length to Licking Run intersecting station; Licking Run Station to White House Rack, Johnson County, Kentucky; 30 miles 6-inch line White House Rack, Johnson County, Kentucky, to Hamlin, Lincoln County, West Virginia, intersecting station 40 miles of 6-inch line, Milton, Cabell County, West Virginia; 2-inch branch line, 20 miles in length from Milton, Cabell County, West Virginia, to Hamlin intersection station; Hamlin, Lincoln County, West Virginia, to Elm Run, Ritchie County, West Virginia; 83 miles of 6-inch line, Elm Run to Braden intersection station, Tyler County, West Virginia; 31 miles 6-inch line, Buckeye-Macksburg pipe line, Vinton Creek Station, Vinton County, Ohio, 43 miles of 3-inch line Wolf Creek, Athens County, to Lowell Station, Washington County, Ohio; 13 miles 4-inch line, Lowell, Ohio, to Eureka intersection station, Eureka, Pleasants County, West Virginia; 18 miles of 6-inch line, Corning Station, Perry County, Ohio, to Elba Junction; 32 miles of 4-inch line branch to Elba, Washington County, Ohio; 4-inch line, 2½ miles in length, Elba Junction, Ohio, to Eureka intersection station, Pleasants County, West Virginia; 20 miles 4 inch line, Payne Station, Washington County, Ohio, to Eureka Station, 8 miles 4-inch line, Eureka pipe line, Eureka intersection station, Eureka, Pleasants County, West Virginia, to Braden intersection station, Tyler County, West Virginia; 31 miles of 6-inch line, Sistersville (Thistle Station), Tyler County, West Virginia, to Braden intersection station, 12 miles of 6-inch line; Braden intersection station, Tyler County, West Virginia, to Downs intersection station, Marion County, West Virginia, 25 miles 6-inch line; Sand Fork Station, Lewis County, West Virginia, to Ten-Mile Station, 32 miles of 6-inch line; Ten-Mile Station to Downs intersection station 19 miles of 6-inch line; Downs intersection station, Marion County, West Virginia, to Ewing intersection station, Washington County, Pennsylvania, 50 miles of 6-inch line; Downs intersection station to Dolls Run Junction, Monongahela County, West Virginia, 16 miles of 6-inch line; Ewing Station, Washington County, Pennsylvania, to Dolls Run Junction, Monongahela County, West Virginia, 9 miles of 6-inch line; Downs intersection station, Marion County, West Virginia, to Morgantown intersection station, Monongahela County, West Virginia, 21 miles of 6-inch line.

Southern Pipe Line

Southern Pipe Line: Morgantown Station, Monongalia County, West Virginia, 6 and 8-inch trunk line to Watson Station, Fayette County, Pennsylvania; Watson Station to State Line Station, Bedford County, Pennsylvania; State Line Station to Knepper Station, Franklin County, Pennsylvania; Knepper Station to Millway Station, Lancaster County, Pennsylvania; Millway Station to Philadelphia terminus oil refinery, Point Breeze, Chester County, Pennsylvania; Millway Station, Lancaster County, Pennsylvania, to Baltimore terminus oil refinery, Baltimore, Md.; Millway Station, Lancaster County, Pennsylvania, to Bayonne seaboard terminus oil refinery, Bayonne, Hudson County, New Jersey.

The Prairie Oil & Gas Co.: W. J. Young, president, Pittsburgh, Pa.; D. J. O'Day, general manager, Lima, Ohio; W. F. Gates, superintendent, Independence, Kans. From Red Fork, Creek Nation, Indian Territory, to Kansas City, Kans. The stations on the line are as follows: Red Fork, Indian Territory, station to territory line station, 6-inch, Chelsea; Cherokee Nation Station to territory line station by way of Bartlesville, Cherokee Nation, to Lawton Station; Cherokee Nation 6-inch line, Lawton to Cleveland, Oklahoma Junction 6-inch line, Cleveland, Okla., Osage Nation to Cleveland Junction, Cherokee Nation, 4-inch line; Cleveland Junction by way of Caney, Montgomery County, Kansas, to Peru Junction, Kans., 6-inch line; Peru, Chautauqua County, to Peru Junction, 3-inch line; Peru Junction, Kans., to Independence, Montgomery County, Kansas, 6-inch line; Coffeyville, Montgomery County, Kansas, to Independence, Kans., 3-inch line; Independence to Neodesha, Wilson County, Kansas, 6-inch line; Cherryvale, Montgomery County, Kansas, to Neodesha, Kans., 3-inch line; Neodesha County, to Humboldt, Allen County, Kansas, 6-inch line; Humboldt by way of Iola to Garnett, Anderson County, Kansas, 6-inch line; Garnett to Paola, Miami, Kans., 6-inch line; Paola to Kansas City, Wyandotte County, Kansas, 6-inch.

Kansas and Indiana Pipe Line: Kansas City, Kans., to Whiting, Ind., 6-inch line.

Indiana Pipe Line: Whiting Lake County, Indiana, terminal; Whiting to Wilders Station, Kankakee, Stark County, Indiana, 8-inch line; Wilders Station to Laketon Station, Wabash County, Indiana, 8-inch line; Laketon Station to Preble Station, Adams County, Indiana, 8-inch line; Preble Station to Montpeller Station, Wells County, Indiana, 6-inch line; Montpeller Station to Borad Ripple Station, Marion, Marion County, Indiana; Preble Station, Adams County, Indiana, to Adgate Station, Lima, Ohio, 8-inch line. The Indiana trunk pipe line follows the route of the Chicago & Alton (Erie) Railroad right of way from Lima, Ohio, to Whiting, Ind.

Buckeye Pipe Line

The Buckeye Pipe Line: St. Mary's Station, Auglaize County, Ohio, to Adgate Station, Lima, Ohio, 6-inch line; Adgate Station to Cygnet Station, Wood County, Ohio, by way of Findlay and North Baltimore, Ohio, 8-inch line; Tontogany Station, Wood County, Ohio, by way of Bowling Green, Ohio, to Cygnet Station, Ohio, 6-inch line; Cygnet Station to Rollersville Station, Sandusky County, Ohio, 6 and 8-inch lines; Rollersville Station to Toledo terminal, 6-inch line; Rollersville to Green Springs Junction Station, Seneca County, Ohio, 8-inch line; Cygnet Station, Wood County, Ohio, to Green Springs Junction Station, Seneca County, Ohio, 8-inch line; Green Springs Junction Station to Wakeman Station, Huron County, Ohio, 8-inch line; Wakeman Station to Berea Station, Loraine County, Ohio, 8-inch line; Berea Station to Mantua Station, Portage County, Ohio, 8-inch line; Montua Station to Cleveland, Ohio, Lake Erie terminal, 6-inch line; Montua Station to Warren Station, Trumbull County, Ohio, 8-inch line; Warren, Ohio, Station to Simpson Station, Lawrence County, Pennsylvania, 8-inch line; Simpson Station to Bear Creek Station, Armstrong County, Pennsylvania, 8-inch line; Bear Creek pump station is known as the mixing station. This station supplies all the trunk lines with Pennsylvania and Lima, Ohio, and Indiana mixed crude oil.

The National Transit Co.'s pipe lines: The officers of the National Transit Co. were as follows: Henry H. Rogers, president; Daniel O'Day, vice president; John Bushnell, controller; George Cheseboro, assistant controller; George W. Colton, treasurer; W. A. Harris, assistant treasurer; F. M. Towl, general superintendent; D. S. Bushnell, assistant general superintendent; Forrest M. Towl, constructing engineer. General office, Standard Oil Building, 26 Broadway, New York. National Transit Co., United Pipe Lines, Upper Division, John O'Brien, superintendent, Bradford, Pa. National Transit Co., United Consolidated, Eureka, Southern, Cumberland (Kentucky), Mellon-Crescent, Southwest Pennsylvania, Buckeye-Macksburg, Lower Division, Henry G. Scrafford, superintendent, Pittsburgh, Pa.

National Transit Lines

Names and route of the several trunk pipe lines in the United and Consolidated Grand Division of the National Transit Co. follow:

Mellon Pipe Line (5-inch line)—Sistersville, W. Va., to Littleton, W. Va.; Littleton, W. Va., to Anderson, Pa.; Anderson, Pa., to Ewing, Pa.

Southwest Pennsylvania Pipe Line (2, 3, 4, 5 and 6-inch line)—Taylortown, Pa., to Cundall, Pa.; Cundall, Pa., to Ewing, Pa.; Washington, Pa., to Ewing, Pa.; McDonald and Oakdale, Pa., to Greggs Station, Pa.; Greggs Station to Ewing, Pa.; Ewing, Pa., to Nedsky, Pa.; Greggs Station, Pa., to Nedsky, Pa.

Crescent Pipe Line (5-inch line)—Greggs Station, Pa., to Millbank, Pa.; Millbank to Ingleside, Pa.; Ingleside to Saxton, Pa.; Saxton to Hays Grove, Pa.; Hays Grove to Florinel, Pa.; Florinel to Marcus Hook, Pa. Seaboard Terminal Refinery, Philadelphia, Pa.

National Transit Co.—United Pipe Lines Division (4, 5, 6 and 8-inch

First pipe line machine at work laying trunk line in Indiana. This "make-up" machine screwed the joints together

"UNCLE BILLY" NEVER WORKED SUNDAY

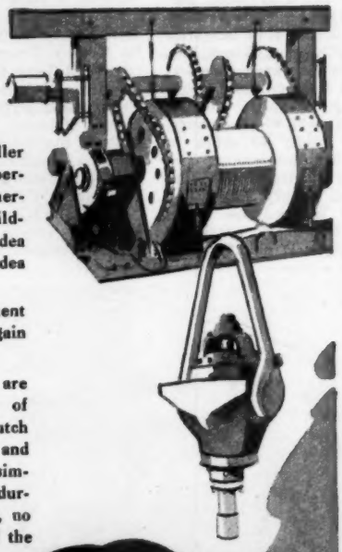
When oil historians began to collect facts about the Drake well a controversy arose as to the precise day on which Uncle Billy Smith struck the pay. Uncle Billy himself, more at home as a blacksmith than as a chronologist, said in 1889, when he was 78 years old, he was certain it was August 12, 1859. But it was easily shown that Uncle Billy's memory had tricked him.

"Saturday, August 28," came to be accepted pretty generally as the date till the late P. C. Boyle, publisher of the Oil City Derrick, pointed out that the Saturdays in August, 1859, were the sixth, thirteenth, twentieth and twenty-seventh. All imporant evidence then went to show that August 27 was the real date.

In the course of a recent chat with Samuel Smith, son of Uncle Billy and the sole living survivor of those who worked on the famous well, he was asked what he knew about this disputed point.

"I don't remember about the day of the month," said Mr. Smith, now 90, as he sat on the front porch of his home in Titusville, "but I am very sure of one thing. It couldn't have been Sunday, for Father never worked on Sunday. He may not have had any scruples about it himself at that time, although later he was an active church worker; but Mother didn't want him to break the Sabbath, and he always did what Mother asked in such matters. So if the twenty-seventh was on Saturday, it must have been August 27."

The FIRST ROLLER BEARING in the Service of Oil



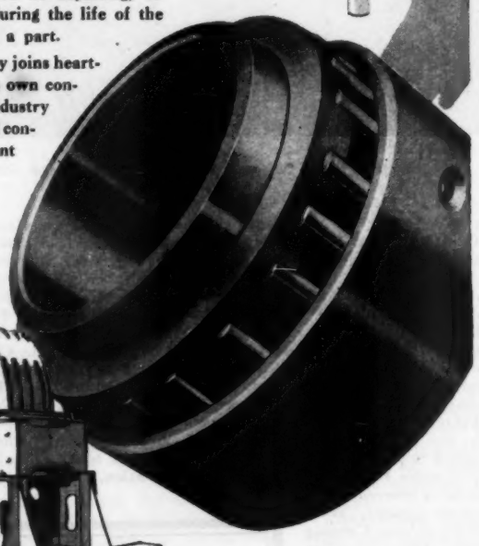
AS early as 1919, somebody thought that roller bearings would be valuable in oil drilling operations and designed a crown block in which an American Heavy-Duty Roller Bearing was used. "Wildfire" symbolizes the immediate spread of the idea that ought to have followed—but didn't. The idea came too soon.

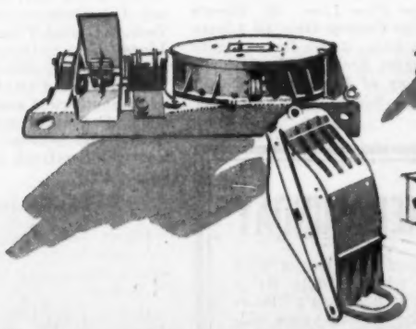
In 1922, however, demands upon drilling equipment had grown so severe that roller bearings were again thought of, reintroduced, and speedily adopted.

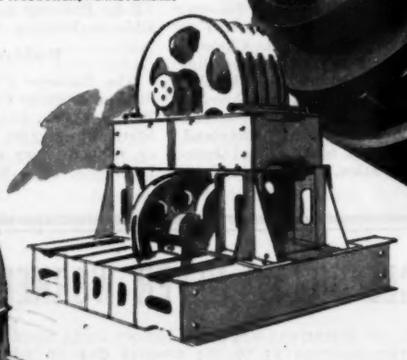
Now, American Heavy-Duty Roller Bearings are standard with seventeen major manufacturers of Crown Blocks, Drawworks, Rotary Drives, Clutch Pulleys, Pumping Units, Swivels, Tractors and Winches. Tremendous load-carrying capacity, simplicity of installation and of use, and unequalled durability commend them. They need no adjusting, no special housing, no replacement during the life of the equipment of which they become a part.

American Roller Bearing Company joins heartily in Oil's Jubilee, is proud of its own contribution to the progress of the industry in recent years, and looks forward confidently to whatever development the future may bring.

AMERICAN ROLLER BEARING COMPANY
PITTSBURGH, PENNSYLVANIA







AMERICAN ROLLER BEARINGS HEAVY DUTY

AMERICAN
Heavy Duty ROLLER BEARINGS

lines)—Scio, Ohio, to Turkey Foot, W. Va.; Turkey Foot to Ewing and Shannapin, Pa.; Ewing Station, Pa., to Shannapin Station, Pa.; Shannapin to Nedsky Station, Pa.; Ewing Station, Pa., to Nedsky Station, Pa.; branch line from Nedsky Station to Allegheny, Pa.; Nedsky Station, Pa., to Bear Creek Station, Pa.; Bear Creek Station to Crown Station, Pa.; Crown Station to Kane Station, Pa.; Kane Station to Colegrove Station, Pa.; Colegrove Station to Hunt's Run Station, Pa.; Hunt's Run to North Point Station, Pa.; North Point Station to Pine Station, Pa.; Pine Station to Latshaw Station, Pa.; Latshaw Station to Millway; intersection station to Point Breeze; Seaboard Terminal Refinery, Philadelphia, Pa.; Millway Station to Baltimore, Md., Seaboard Terminal Refinery; Millway Station, Pa., to Bayonne, N. J., Seaboard Terminal; Colegrove Station, Pa., to Olean, N. Y., intersection station; Kane Station, Pa., to Olean, N. Y., intersection station, to Buffalo, N. Y., lake terminal; Olean Station, N. Y., to Wellsville Station, N. Y.; Wellsville Station to Cameron Mills Station, N. Y.; Cameron Mills Station to West Junction Station, N. Y.; West Junction Station to Catatonk Station, N. Y.; Catatonk Station to Osborne Hollow Station, N. Y.; Osborne Hollow to Hancock Station, N. Y.; Hancock Station to Cocheton Station, N. Y.; Cochecton Station to Swartwout Station, N. Y.; Swartwout Station to Newfoundland Station, N. J.; New Foundland Station to Saddle River Junction Station, N. J.; Saddle River Junction Station to Terminal Refinery, Brooklyn, N. Y.; Saddle River Junction Station to the Seaboard Terminal Refinery, Bayonne, N. J.

Pacific Coast Oil Co. Pipe Line, California (Standard Oil Co.)—Length of line, 280 miles; size of line, 8 inches. Route of line: Waite Station, Kern County, California, to Pond Station, Kern County; Pond Station to Corcoran Station, Tulare County, California; Corcoran Station to Lethent Station, Fresno County, California; Lethent Station to Mendota intersecting station; Mendota intersecting station to Los Palos Station, Fresno County, California; Los Palos Station to Newman Station, Merced County, California; Newman Station to Vernalis Station, San Joaquin County, California; Vernalis Station to McCabe Station, Contra Costa County, California; McCabe Station to Maltby Station, Contra Costa County, California; Maltby Station to Port Richmond Terminal Refinery, San Francisco Bay, Calif.

Security Oil Co. Pipe Line, Texas (Standard Oil Co.)—Size of line, 8 inches. Route of line: Batson to Sour Lake, Sour Lake to Beaumont, Beaumont to Sabine Pass, Seaboard Terminal Refinery.

Tide Water Pipe Line Co., Ltd. (operated under agreement with the Standard Oil Co.)—Size of line, 6 inches. Route of line: Tarport, East Bradford, Pa., to Station No. 1, Rixford, Pa.; Station No. 1 to Station No. 2, Olmsted, Pa.; Station No. 2 to Station No. 3, County Line, Pa.; Station No. 3 to Station No. 4, Muncy Station, Pa.; Station No. 4 to Station No. 5, Shumans, Pa.; Station No. 5 to Station No. 6, Hudsondale, Pa.; Station No. 6 to Station No. 7, Changewater, N. J.; Station No. 7 to Seaboard Terminal Refinery, Bayonne, N. J.

Crude and Refined Lines

United States Pipe Line Co. (Independent and Standard)—Incorporated September 6, 1892. Capital stock, $2,000,000. Michael Murphy, president; J. W. Lee, vice president; I. G. Jackson, secretary; W. W. Tarbell, treasurer; H. J. Wing, superintendent. Directors: Michael Murphy, New York; R. M. Jennings, Pittsburgh, Pa.; Louis Walz, Oil City, Pa.; Delevan Emery, Bradford, Pa.; Hugh King, New York; Peter Theobold, Titusville, Pa.; J. W. Lee, Pittsburgh, Pa.; Thomas W. Phillips, New Castle, Pa.; Joseph Seep, C. N. Payne, Titusville, Pa.; J. C. McDowell, Pittsburgh, Pa.

Crude and refined lines; size of lines, 4 and 5 inches. Route of lines: Titusville, Pa., to Warren, Pa., 31 miles; crude line 5 inches, refined line, 4 inches; Warren, Pa., to Bradford, Pa., 30½ miles; crude line 5 inches, refined line 4 inches; Bradford, Pa., to Westfield Station, Pa., 57½ miles; crude line 4 inches, refined line 5 inches; Westfield Station, Pa., to Athens Station, Pa., 53 4/5 miles; crude line 4 inches, refined line 5 inches; Athens to Parkson Station, 63 3/5 miles; crude line 4 inches, refined line 5 inches; Parkson to Freemansburg, Pa., loading rack, 59 miles; Freemansburg to Marcus Hook Terminal Refinery, Philadelphia, Pa., 64.1 miles; crude line 4 inches, refined line 5 inches.

Hauling compressor in Kentucky

Producers & Refiners Pipe Line Co., Ltd. (Independent)—Size of line, 2, 4 and 6 inches. Route of line: Trail Run, Ohio, Station to Sistersville Station, W. Va.; Sistersville Station to Pine Grove Station, W. Va.; Pine Grove Station, W. Va., to Taylorstown Station, Pa.; Taylorstown Station to Washington Junction, Pa.; Washington Junction to Primrose Station, Pa.; Primrose Station to Coraopolis Station, Pa.; Primrose Station via McDonald, Noblestown and Oakdale, Pa., to Coraopolis Station; Coraopolis to Adams Station, Pa.; Adams to Butler, Pa.; Butler to Karns City, Pa.; Karns City to Dotters Station, Pa.; Dotters Station to Oil City, Pa.; Oil City to Titusville, Pa., then intersecting with the United States Pipe Lines.

Emery Pipe Line (Independent)—Lewis Emery, Jr., owner. Route and size of line: Sugar Run, Pa., to Sarksville, Pa., 40 miles, 3¼-inch line; Riterville to Bradford, Pa., 18 miles, 3 and 4-inch line.

Texas Pipe Lines

Higgins Pipe Line, from Batson to Sour Lake; 6-inch line.

United Oil & Refining Co., Sour Lake to Beaumont; 6-inch line.

National Oil & Pipe Line Co., Beaumont to Port Arthur; 6-inch line.

Franklin Pipe Co., Ltd., Franklin, Pa. J. W. Grant, president; D. Grimm, secretary; E. Black, superintendent. Size of pipe line, 2, 3 and 4 inches. Route of line: Franklin oil field to refinery and loading rack, Franklin, Pa.

Cornplanter Pipe Line Co., Warren, Pa. Size of pipe line, 2 inches. Route of line: Tiona, Clarendon, Stoneham, Glade Run and Glade to refinery, East Warren, Pa.

Pipe Lines in California

California companies became more active in constructing pipe lines from the different fields being developed in that State to refineries during the latter part of this third era in the history of transportation. Longer and larger lines were laid, forming the background of the extensive pipe line system to be constructed later in that State.

The Union Oil Co. was formed in California in 1890. It took over the Pico-Ventura line of the Mission Transfer Co., and in 1896 built a pipe line from the Whittier-Fullerton production to Los Angeles.

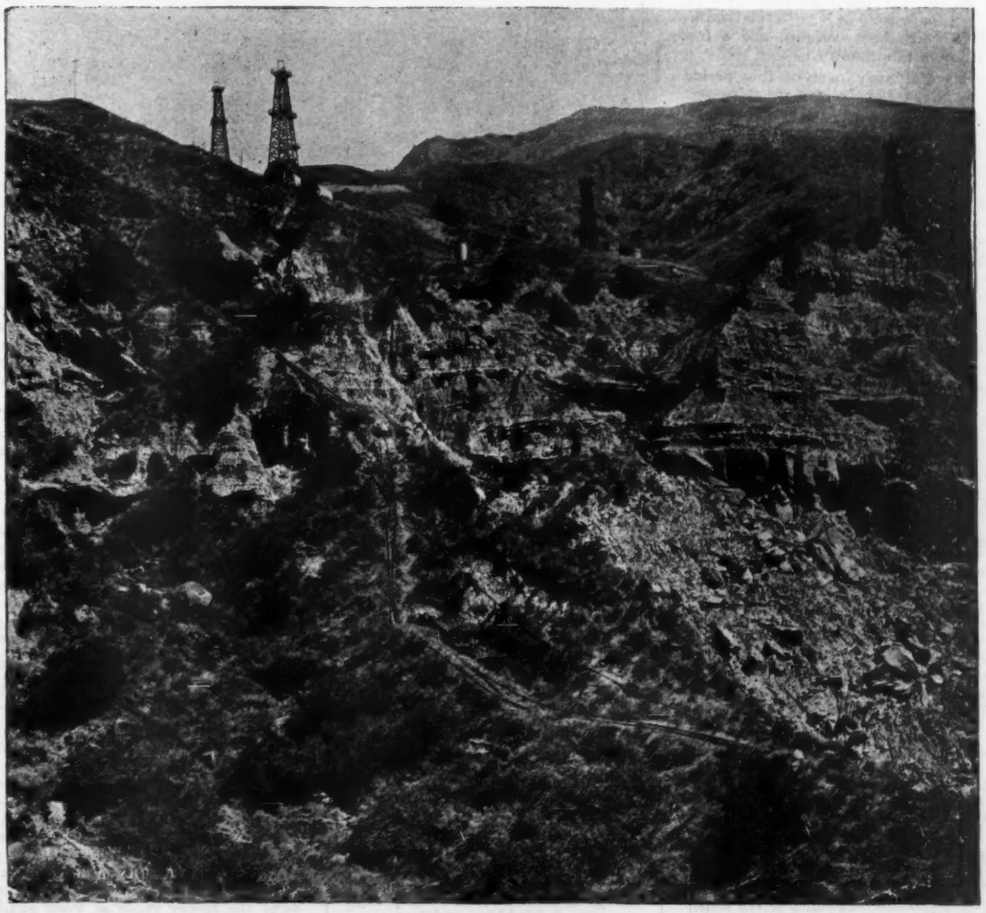
A unique pipe line system was built in 1897 by the Alcatraz Refining Co. from its heavy oil seepages in the Santa Maria Field to a small refinery near Gabiota—a 3-inch and a 4-inch line in parallel. This system was operated by pumping distillate from the refinery and mixing it with the thick, viscous oil so as to make pumping of the latter possible.

Mixing mud for the drilling of the famous Lucas gusher, the discovery well of Spindletop, Texas, was a comparatively simple proposition. The mud, so the story goes, was obtained from a nearby puddle, which was kept stirred up by a bunch of cattle wallowing around in it.

In 1901 the Standard Oil Co. moved the Pacific Coast Oil Co.'s refinery from Alameda to Point Richmond, and in 1902-03 the Standard Oil Co. completed a 208-mile 8-inch line from the Kern River Field to Point Richmond. A 6-inch branch line from this 8-inch trunk line was built into the Coalinga Field.

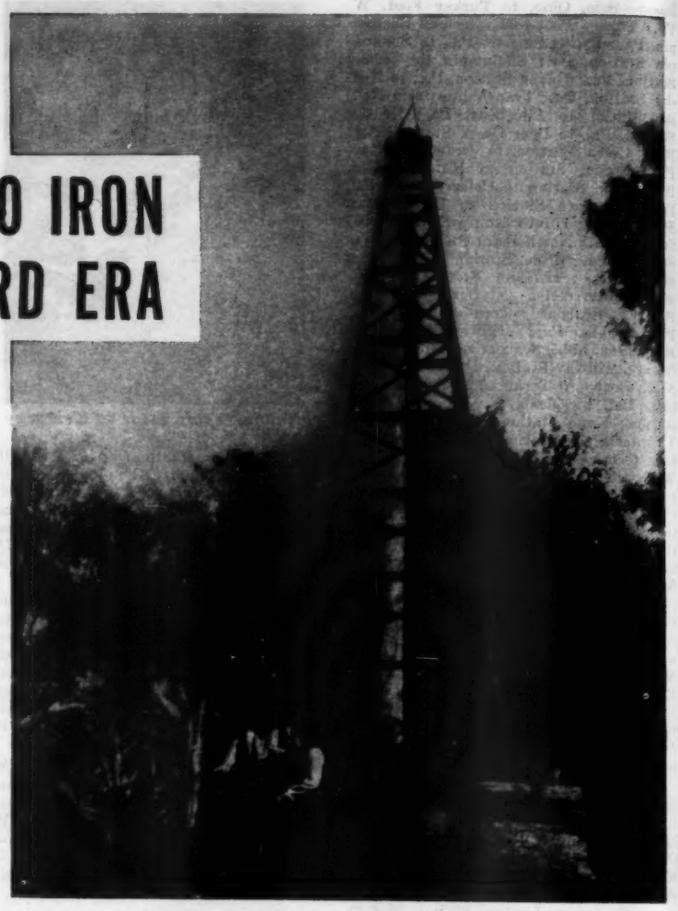
First Tanker From Gulf Coast

The J. S. Cullinan Pipe Line Co. had erected steel storage at Sabine Pass, Tex., in 1899 to provide coastwise shipment of Corsicana crude in tankers. These tankers were not used until March, 1902, when the tanker Atlas of the Standard Oil Co.'s fleet was loaded with Spindletop crude. It was the first tanker to leave a Texas port.



Pipe lines laid on surface of the ground in Ventura County, California

TRANSITION FROM WOODEN TO IRON EQUIPMENT STARTED IN THIRD ERA



Oil well completed in 1892 on north bank of Verdigris River near Neodesha, Wilson County, Kansas, by W. M. Mills of Osawatomie, Kans.

DEVELOPMENT—ERA NUMBER 3 1889-1904

Development of equipment for drilling wells and producing oil during the third period of the oil industry, 1889-1904, was largely confined to the use of better materials and increasing the size of the parts. Cable tool drilling and beam pumping were still practiced in most fields although at the end of the period the rotary outfit had been tried with success and was recognized as offering possibilities for future exploration for oil and gas. Rig irons had been increased in size and weight and more metal parts were being used. Bull wheel shafts were of larger diameter and the gudgeons and gudgeon bands were much heavier than on the original rigs. The use of large diameter pipe for bull wheel shafts had been suggested. Also steel derricks with steel samson posts, jack posts and walking beams had been designed and a few sets made in this country.

During the early part of this period drilling in the Appalachian province was still receiving the greatest amount of attention with the Pennsylvania oil region getting the biggest play and the oil men following the "trend" into West Virginia and southeastern Ohio. The oil fields of northwestern Ohio and northeastern Indiana in the Lima area were receiving a lot of attention, especially after a process had been devised to remove the sulphur from the kerosene.

The first oil in Texas was developed in a shallow well drilled in Nacogdoches County in 1887, but the first real oil field development in that state occurred in Navarro County where oil was struck in a well drilled for water in the town of Corsicana. The wells were located so far from the points of consumption that the development was relatively slow. California continued to report new fields in the period between 1889-1904, but mostly shallow wells were drilled there until the Midway-Sunset Field was opened in 1900.

All of this development was carried on by using cable tools and for the most part steam boilers and engines furnished the power, but it is reported that the rotary outfit had its inception in the Corsicana shallow fields although the completion of the famous "Lucas" gusher in Spindletop with an estimated capacity of 70,000 to 150,000 bbls. daily directed attention to the rotary outfits.

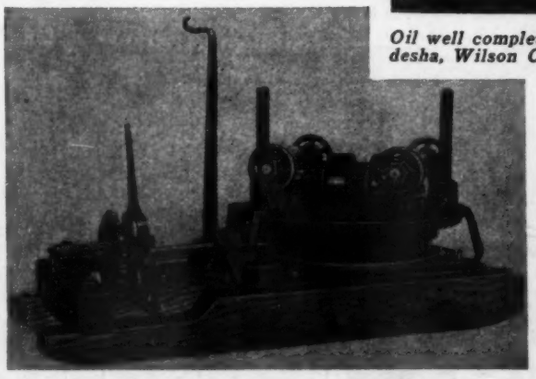
History of Rig Irons

As the use of rig irons and cable tools was at its zenith during the third period of the petroleum industry development in this country it may be appropriate to recite something of the development of this type of equipment. Much of the history given here has been furnished by John M. Crawford, chairman of the board of directors, The Parkersburg Rig & Reel Co., Parkersburg, W. Va.

It seems probable that the first company to engage in the manufacture of rig irons was the Gowanda Iron Works of Gowanda, N. Y. It is reported that it was making rig irons for use on wells drilling for oil shortly after the Drake well was completed in 1859.

It is also reported that John Eaton and his associates came from Massachusetts to Oil City, Pa., shortly after the Drake well was completed and established a business for the distribution of oil well supplies under the name of Eaton, Cole and Burnham. Later these men organized as the Oil Well Supply Co. and opened branches in all of the active oil fields.

It was during the Bradford, Pa., drilling excitement in 1875 that another supply company was formed by Bayne, Wilson and Pratt that later became incorporated as the National Supply Co. These companies sold rig irons and hardware for drilling and pumping wells and through their efforts the business grew and the type of equipment was maintained at a high standard.



First rotary outfit used for drilling for oil built in Corsicana, Tex., and placed on market in 1901

George Corbett of Bradford, Pa., was granted several patents on various rig iron parts, particularly the gudgeons (1878), center irons, sand reels and designs for the portable drilling machines.

Another old timer engaged in the development of rig irons and parts was William Forgie of Washington, Pa., who traveled over all the oil fields of his day selling various types of equipment. Mr. Forgie secured a patent upon the flanged type gudgeon in 1891 but the courts later decided that the patent was anticipated by George Corbett.

A well was completed and put on production in the Powell Field, Texas in 1906 in 36 hours. A 4-inch hole, 749 feet deep, drilled with a rotary rig, averaged 50 bbls. a day.

John M. Crawford organized the Parkersburg Rig & Reel Co. in 1897. The first rig irons built by this firm were 4 and 4½-inch size, the size being determined by the diameter of the crankshaft.

Ten years later, or 1907, the transition to 5-inch irons was beginning and in 1917, or after another 10 years, the so-called "California" pattern 6-inch rig irons were introduced and came into general use in the next two or three years during the drilling excitement of 1919-1920.

Trend of Development

In the early days of the oil industry wood was available from forests near the fields and the metal parts were forged by blacksmiths in shops set up at the rig or in the towns nearby. As the number of drilling operations increased the manufacture of metal parts for the rigs expanded until this was sufficiently important to induce several firms to specialize in this equipment. Other firms specialized in pipe and still others in boilers and engines.

The steel industry had grown up in Pittsburgh and provided an ample supply of iron and steel for the manufacture of parts for the rigs and during the same period of development of the steel business the forests near the oil fields were gradually depleted and good lumber and timbers were becoming increasingly harder to secure. To supplement the poorer grade of wood available for rigs more and more iron parts were used and in this manner the cable tool drilling was developed so that holes 3,000 to 4,000 feet deep could be drilled.

This tendency to provide equipment suitable for the ever deeper drilling operations has continued up to the present day of 11,000-foot holes. For the shallower wells the portable type drilling rigs were developed and found favor in the older fields and in shallower pools of the Pennsylvania oil region and westward into Ohio, Kentucky, Tennessee and Illinois. Where oil could be developed at depths below 2,500 feet the oil man was ready to make a play and the equipment manufacturer had the machinery and supplies ready for this heavier duty.

Deep Well in 1898

R. B. Woodworth, engineer, Carnegie Steel Co., in a paper presented before the structural section of The Engineer's Society of Western Pennsylvania May 4, 1909, states that the deepest well in the United States in 1898 was drilled by the Forest Oil Co. upon the William Bedell farm near West Elizabeth, 12 miles south of Pittsburgh, in Pennsylvania, and had a total depth of 5,575 feet.

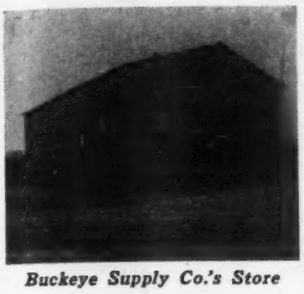
At the depth of 5,500 feet the crown pulley broke and cut the rope, dropping the tools 100 feet and plugged the hole. To drill this well it required extra heavy machinery consisting of two 25-horsepower engines and boilers, three bull ropes, 16-inch belt, 13½-foot band wheel, 5-inch forged crank shaft, two brakes on bull wheels and two cables spliced together. The weight of the cable was about 14,000 pounds and the approximate cost of the well was $40,000.

This specification seems to indicate that wire lines were being used for drilling in 1898 and this is further indicated by the fact that it is reported that wire drilling lines were first used "during the middle nineties."

It appears that wire lines were introduced into the industry first in the form of the light sand lines. These lines, made

of wire, were used to run the bailer into and out of the hole because they were easier to handle than the manila rope and had the required strength for this duty.

It is reported that larger wire lines were first used for pulling liners and similar work around the wells where greater strength than to be had in manila



Buckeye Supply Co.'s Store

Long-panel steel derrick, erected at McDonald, Pa., in 1903

lines was necessary. As the 1-inch diameter wire lines were wound on the bull wheels it is logical to assume that the drillers tried them out for drilling, but it is understood that the first wire lines were equipped with "manila snappers" between the tools and the lower end of the wire line to give the required motion to the tools and it was a long time before the old-time drillers would concede that the wire lines could be attached directly to the tools and make hole.

Combination Steam and Gas Engines

Evolution of equipment in the oil fields seems to have been gradual and for the most part changes were not effected until the supply of some particular article became limited and prices increased. Change in fuel supply had its effect upon the type of power units used and it is reported that about 1900 the gas supply in the eastern states was so depleted that a gas engine cylinder was made to replace the steam cylinder on the oil-field drilling and pumping engines so that gas might be used directly in the engine instead of burned under the boiler with the loss in conveying steam from boiler to engine.

A McDonald, Pa., manufacturer is credited with developing a convertible gas and steam cylinder. An engine equipped with this cylinder was used as as a gas engine for the lighter duty of pumping the wells. Steam was turned into the cylinder for the heavier duty of pulling rods and tubing and cleaning out the wells.

Manufacturers used oil-field steam engine dimensions in designing these gas engines and convertible gas and steam cylinders, so they could supply a gas cylinder or convertible steam and gas cylinder with the necessary instructions for installation on the steam engine bed for any size and make of gas engine.

While there was opportunity to make some choice between the gas and steam engine during this third period of the oil industry there was considerable rivalry between manufacturers of each class of equipment. The steam engines seem to have been the most generally used but on pumping wells the problem confronting the producer was cost of operating one boiler and engine at each well. If the well pumped 24 hours a day it meant the wages of two men and only relatively good pumping wells could stand such an expense.

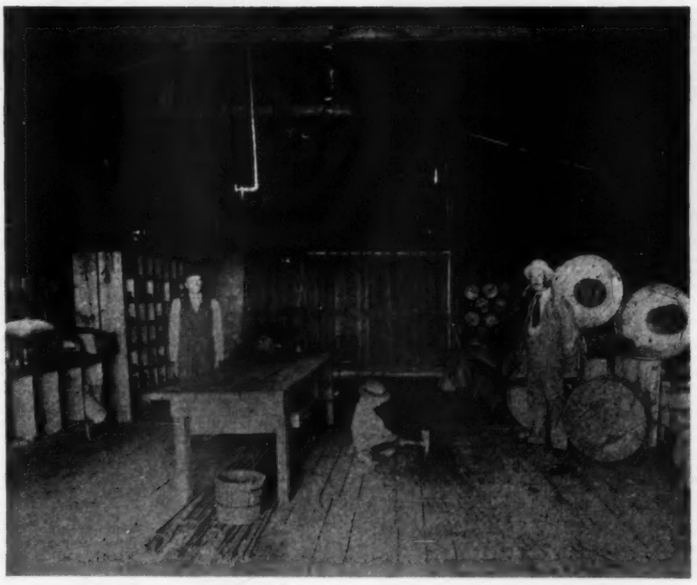
The plan was then worked out to operate several steam engines from one central boiler. This required the piping of the steam considerable distances and it condensed and some of the engine builders of that period made the general claim that their engines would "give a free outlet to condensed water and enable the engine to run with freedom at a distance of 2,000 feet from the boiler."

The gas engine manufacturers recognized the opportunities presented but they too were confronted with the problem of making one engine pump more than one well and to solve this the pump jack was designed, and for pumping more than two wells the "power" followed.

A writer of that period states that "a jack is the device that changes the horizontal movement of the surface rods which come from the power to the well to the vertical movement of the sucker rods which are in the well, and the power is the device that receives the work of the engine and distributes it to a number of wells in the surrounding neighborhood."

Early in the nineties manufacturers were devoting time and money to developing an oil country type gas engine. There were gas engines available that would operate on manufactured gas, but the idea of the oil field equipment manufacturer was to utilize the natural gas that accompanied the oil directly in the cylinder of the gas engine and to secure such an engine required complete development of the unit because the makers of the manufactured gas engines would not divulge any of the principles of their machine.

It is reported that the first oil field gas engines were put on the market in 1894 and gradually grew in favor until they practically replaced the steam engines for pumping wells either by direct connection to the beams or through central powers.



Interior view of supply store built at Neodesha, Kans., in 1894 by M. P. Colt and operated by him under the name of the Buckeye Supply Co., said to have been the first supply store in the Mid-Continent

Steel Derrick and Accessories

It was in the third period that the use of structural steel for derricks was suggested by engineers for the manufacture of steel shapes with shops in Pittsburgh. The connection between the steel and petroleum industries was relatively close during that time for the activity of the oil industry was still largely confined to the Pennsylvania oil regions located not far from Pittsburgh, the steel and iron center.

As long as cheap lumber was to be had from saw mills close to the oil fields there was little incentive for turning to steel for derricks. But as the sawmills were closed for lack of a local source of timber and lumber had to be shipped into the fields engineers connected with the steel industry saw an opportunity to supplant wood derricks with steel structures and such a unit is shown in a catalog published in 1892 with the following description:

"It is practically indestructible, made of light pieces easily transported and handled, which are fastened together with bolts; every part is made of steel; power is applied by rope running through double grooves in engine pulley, band wheel and sand reel head. The first rig of this kind was sent to Australia for use in a district where wood decayed rapidly."

This last sentence seems to cover the steel derrick situation in this country for many years after this date. Derricks were manufactured in this country but shipped abroad until the fourth period of the industry when they were accepted by operators in the fields of the United States, first to replace wooden derrick over pumping wells, and later for drilling purposes.

Introduction of Rotary

The rotary drilling outfit is reported to have entered the petroleum industry through the development of equipment that was first built by M. C. and C. E. Baker, water well drilling contractors of South Dakota who brought their outfit to Corsicana, Tex., after 1895 when they were directed to that town by the reported discovery of oil there.

Three well drillers, H. G. Johnston, E. H. Aikin and Charles Rittersbacker, had been drilling water wells in Kansas by cable tool methods and had worked their way to Corsicana where they had contracted to drill a water well for the city. In completing this well oil was discovered, opening the first commercial field in Texas in 1896. As this field was developed these three drillers were kept busy and found difficulty in getting their tools repaired, so they opened a little shop to take care of their own needs and also took in some custom work besides. This was the beginning of the American Well & Prospecting Co. and it was in existence when the Baker brothers arrived in Corsicana with their rotary outfit.

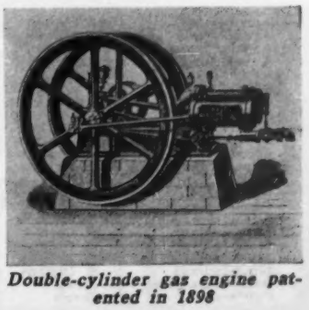
The early history of the development of the rotary system by the Baker brothers while at work drilling artesian water wells in Yankton, Dakota Territory, in 1882 is worth repeating.

In doing this work the Baker brothers used what they termed the "jetty" system wherein water was poured into the well hole and allowed to escape upward through the hole in the bit and through the hollow drill stem. The drill stem was equipped with a series of valves which were expected to hold the mud as it was forced upward. As the well was deepened this method failed to work because the mud would not rise freely in the stem.

The idea was then conceived that if the course of the water was reversed and it was introduced through the drill stem the cuttings would escape to the surface in the annular space between the stem and the walls of the hole. Pouring the water into the upper end of the drill pipe was slow and it was then decided to force the water down the stem and out through the hole in the bit using the force of gravity supplied by flowing the water from an adjacent water well that was pumped by a windmill. This worked well and the next problem was to provide a means for turning the drill stem.

This stem was nothing more than small diameter pipe and it had been customary to turn it by hand but to simplify this method grips were designed to rotate the pipe as it was held within a ring mounted upon wooden skids. Power to rotate

Edward L. Doheny and Frank R. Seaver at first well dug by Doheny in 1892 in Los Angeles Field, California



Double-cylinder gas engine patented in 1898

the pipe was furnished by horses driven in a circle around the hole.

Means of holding the drill pipe approximately vertical and reducing the "wobble" to a limited area were provided by using short lengths of casing at the mouth of the drilled hole. Bevel gears were also provided by means of which the outfit could be rotated in either direction.

This crude device was brought to Corsicana and the American Well & Prospecting Co. realized the possibilities for using it in the soft soils encountered in Texas where they had been drilling, and they undertook to adapt it to the needs of the drilling contractors there, and out of this effort came the first rotary used to drill an oil well in Spindletop Field in 1901.

The outfit popular in 1901 consisted of a 9x12 steam engine weighing about 2,000 pounds and costing about $250. The drawworks weighed about 5,000 pounds and cost $250, and the slush pump used was an 8x5x10-inch machine weighing 2,000 pounds and costing $235. The traveling block had 16-inch sheaves and weighed 300 pounds and cost $115. This is the type outfit that made the completion of the Lucas well in Spindletop possible and started the oil development west of the Mississippi River.

OIL DISCOVERED 1889 to 1904

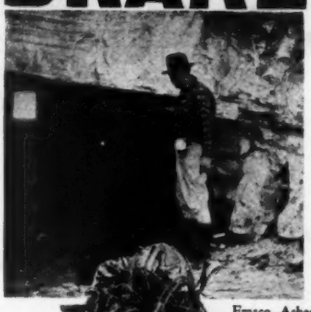
Year	Province—	State—	Field—	County—
1889	Appalachian	Pennsylvania	Burgettstown	Washington
	Appalachian	Pennsylvania	Chartiers	Allegheny
	Appalachian	Pennsylvania	Coraopolis	Allegheny
	Appalachian	Pennsylvania	Eldersville	Washington
	Appalachian	Pennsylvania	Elizabeth	Allegheny
	Appalachian	Pennsylvania	Florence	Washington
	Appalachian	Pennsylvania	Glade	Butler
	Appalachian	Pennsylvania	Mars	Butler
	Appalachian	Pennsylvania	McCurdy	Allegheny
	Appalachian	Pennsylvania	McDonald	Washington
	Appalachian	Pennsylvania	Richhill	Greene
	Appalachian	Pennsylvania	Slippery Rock	Lawn
	Appalachian	Pennsylvania	Willett	Indiana
	Appalachian	C. & S. E. Ohio	Newcastle	Monroe
	Appalachian	C. & S. E. Ohio	Newell's Run	Washington
	Appalachian	West Virginia	Fairview	Marion
	Appalachian	West Virginia	Cairo	Ritchie
	Appalachian	West Virginia	Harrisville	Ritchie
	Appalachian	West Virginia	Sistersville	Tyler
	Appalachian	West Virginia	Archers Fork	Belmont
	Appalachian	Kentucky	Gas Hollow	Barren
	Appalachian	Kentucky	Litchfield	Grayson
	Appalachian	Kentucky	West Point	Hardin
	Lima-Indiana	N. W. Ohio	Scott Twp.	Sandusky
	Lima-Indiana	N. W. Ohio	Jennings Twp.	Van Wert
	Lima-Indiana	N. W. Ohio	Montgomery Twp.	Wood
	Lima-Indiana	N. W. Ohio	Plain Twp.	Wood
	Lima-Indiana	N. E. Indiana	Harrison	Blackford
	Lima-Indiana	N. E. Indiana	Delphi	Carroll
	Lima-Indiana	N. E. Indiana	Van Buren	Grant
	Lima-Indiana	N. E. Indiana	Chester	Wells
	Mid-Continent	Kansas	Fredonia	Wilson
	California	California	Squaw Flat	Ventura
	California	California	Little Scope	Ventura
	California	California	Los Angeles-Salt Lake	Los Angeles
1891	Appalachian	Pennsylvania	Clintonville	Butler
	Appalachian	Pennsylvania	Moon	Allegheny
	Appalachian	Pennsylvania	Muddy Creek	Butler
	Appalachian	Pennsylvania	Rodfield	Allegheny
	Appalachian	C. & S. E. Ohio	Toronto	Jefferson
	Appalachian	C. & S. E. Ohio	Sistersville	Monroe
	Appalachian	C. & S. E. Ohio	Corning	Perry
	Appalachian	West Virginia	Sistersville	Doddridge
	Appalachian	West Virginia	Centerpoint	Doddridge
	Appalachian	West Virginia	Tanner	Gilmer
	Appalachian	West Virginia	Whiskey Run	Ritchie-Wood
	Lima-Indiana	N. W. Ohio	Eagle Twp.	Hancock
	Lima-Indiana	N. W. Ohio	Union Twp.	Hancock
	Lima-Indiana	N. W. Ohio	Oregon	Lucas
	Lima-Indiana	N. E. Indiana	Nottingham Twp.	Wells
	Mid-Continent	Oklahoma	Chelsea	Rogers
	California	California	Summerland	Santa Barbara
1892	Appalachian	Pennsylvania	Evans City	Butler
	Appalachian	West Virginia	Glenville	Gilmer
	Appalachian	West Virginia	Elk Fork	Tyler
	Appalachian	West Virginia	.....	Wetzel
	Appalachian	West Virginia	Smithfield	Wetzel
	Appalachian	Kentucky	Beaver Creek	Floyd
	Appalachian	Kentucky	Slickford	Wayne
	Appalachian	Tennessee	Spurrier	Fentress
	Lima-Indiana	N. E. Indiana	Hartford	Adams
	Lima-Indiana	N. E. Indiana	Wabash	Adams
	Mid-Continent	Kansas	Coffeyville	Montgomery
	Rocky Mountain	Utah	Salt Lake	Boxelder
	California	California	O'Hara (Paula)	Ventura
	California	California	Los Angeles City	Los Angeles
	California	California	Conejo	Ventura
1893	Appalachian	Pennsylvania	Garvin	Butler
	Appalachian	Pennsylvania	Keown	Allegheny
	Appalachian	Pennsylvania	Rockville	Armstrong
	Appalachian	C. & S. E. Ohio	Archer Fork	Washington
	Appalachian	West Virginia	Whetstone Run	Marion
	Appalachian	West Virginia	Williamstown	Wood
	Lima-Indiana	N. W. Ohio	Union Twp.	Mercer
	Lima-Indiana	N. E. Indiana	Bear Creek	Jay
	Mid-Continent	Kansas	Cherryvale	Montgomery
	Mid-Continent	Kansas	Independence	Montgomery
	Mid-Continent	Kansas	Neodesha	Wilson
	California	California	Rice Canyon	Los Angeles
	California	California	Towsley	Ventura
	California	California	Eureka	Ventura
	California	California	Pirie	Ventura
1894	Appalachian	Pennsylvania	Finleyville	Washington
	Appalachian	Pennsylvania	Girty	Armstrong
	Appalachian	Pennsylvania	Glenhazel	Elk
	Appalachian	Pennsylvania	Homestead	Allegheny
	Appalachian	Pennsylvania	Little Mud Lick Creek	Armstrong
	Appalachian	Pennsylvania	New Salem	Armstrong
	Appalachian	Pennsylvania	North Washington	Butler
	Appalachian	Pennsylvania	Ormsby	McKean
	Appalachian	Pennsylvania	Roaring Run	Armstrong
	Appalachian	Pennsylvania	Venice	Washington
	Appalachian	C. & S. E. Ohio	Colerain	Belmont
	Appalachian	C. & S. E. Ohio	Benwood	Monroe
	Appalachian	C. & S. E. Ohio	Moore's Junction	Washington
	Appalachian	West Virginia	Carson	Hancock
	Appalachian	West Virginia	.....	Lewis
	Appalachian	West Virginia	Fink	Lewis-Doddridge
	Appalachian	West Virginia	Flat Run	Marion-Monongalia
	Appalachian	West Virginia	Jakes Run	Monongalia
	Appalachian	West Virginia	Willow Island	Pleasants
	Appalachian	West Virginia	Big Moses	Tyler
	Appalachian	West Virginia	Little Flint	Doddridge
	Lima-Indiana	N. W. Ohio	Middletown Twp.	Wood
	Lima-Indiana	N. W. Ohio	Troy Twp.	Wood
	Lima-Indiana	N. E. Indiana	Penn	Jay
	Lima-Indiana	N. E. Indiana	Jackson	Wells
	Rocky Mountain	Wyoming	Douglas	Converse
	California	California	Mud Springs	Los Angeles
1895	Appalachian	Pennsylvania	Glenfield	Allegheny
	Appalachian	Pennsylvania	Lickskillet	Allegheny
	Appalachian	C. & S. E. Ohio	Jewett	Harrison
	Appalachian	C. & S. E. Ohio	Gould	Jefferson
	Appalachian	C. & S. E. Ohio	Sand Hill	Washington
	Appalachian	C. & S. E. Ohio	Wilson Run	Washington
	Appalachian	C. & S. E. Ohio	Wingate P. O.	Washington
	Appalachian	West Virginia	Board Tree	Marshall
	Appalachian	West Virginia	Broad Run	Pleasants
	Appalachian	West Virginia	Hardman	Tyler
	Appalachian	West Virginia	Sancho Creek	Tyler
	Appalachian	West Virginia	Wick	Tyler
	Appalachian	West Virginia	Dye-Brooks	Tyler
	Appalachian	West Virginia	Waverly	Wood
	Appalachian	Kentucky	Cooper	Wayne
	Lima-Indiana	N. W. Ohio	Liberty Twp.	Seneca
	Mid-Continent	North Texas	Mildred	Navarro
1896	Appalachian	Pennsylvania	Bristoria	Greene
	Appalachian	Pennsylvania	Criders	Butler
	Appalachian	Pennsylvania	New Freeport	Greene
	Appalachian	Pennsylvania	Peters	Butler
	Appalachian	Pennsylvania	Rosenberg	Butler
	Appalachian	C. & S. E. Ohio	Knoxville	Jefferson
	Appalachian	C. & S. E. Ohio	Guysville	Monroe
	Appalachian	C. & S. E. Ohio	Jackson Ridge	Monroe
	Appalachian	C. & S. E. Ohio	Hendershot	Washington
	Appalachian	C. & S. E. Ohio	Hohman	Washington
	Appalachian	C. & S. E. Ohio	Sheets Run	Washington
	Appalachian	West Virginia	Adaline	Marshall
	Appalachian	West Virginia	Belton	Marshall
	Appalachian	West Virginia	Cameron	Marshall
	Appalachian	West Virginia	Little Graveck	Marshall
	Appalachian	West Virginia	Cornwallis	Ritchie
	Appalachian	West Virginia	Conway	Tyler
	Appalachian	West Virginia	Kyle	Tyler
	Appalachian	West Virginia	Stringtown	Tyler-Doddridge-Wetzel
	Appalachian	West Virginia	Piney Fork	Wetzel
	Appalachian	West Virginia	Murphytown	Wood
	Appalachian	Kentucky	Stinking Creek	Knox
	Appalachian	Tennessee	Riverton	Pickett
	Lima-Indiana	N. W. Ohio	.....	Putnam
	Lima-Indiana	N. W. Ohio	Rice Twp.	Sandusky
	Lima-Indiana	N. E. Indiana	Washington	Grant
	Lima-Indiana	N. E. Indiana	Jefferson	Huntington
	Lima-Indiana	N. E. Indiana	Wayne	Huntington
	Lima-Indiana	N. E. Indiana	Jackson	Jay
	Lima-Indiana	N. E. Indiana	Liberty	Wells
	Mid-Continent	North Texas	Corsicana	Navarro
	California	California	Sargent	Santa Clara
	California	California	Oil City	Fresno
	California	California	East Side	Fresno
	California	California	West side	Fresno
	California	California	Bardsdale	Ventura
1897	Appalachian	Pennsylvania	Crows Run	Beaver
	Appalachian	Pennsylvania	Fonner	Greene
	Appalachian	Pennsylvania	Grays Fork	Greene
	Appalachian	Pennsylvania	Say	Armstrong
	Appalachian	West Virginia	.....	Cabell
	Appalachian	West Virginia	Campbell Run	Marion
	Appalachian	West Virginia	Flat Fork of Poca	Roane
	Appalachian	West Virginia	Flat Rock (Poca)	Wirt
	Appalachian	West Virginia	Hendershot	Wood
	Appalachian	Kentucky	Oil Valley	Wayne
	Lima-Indiana	N. W. Ohio	Big Lick Twp.	Hancock
	Lima-Indiana	N. E. Indiana	Washington Twp.	Delaware
	Lima-Indiana	N. E. Indiana	Alexandria	Madison
	Lima-Indiana	N. E. Indiana	Broad Ripple	Marion
	Lima-Indiana	N. E. Indiana	Peru	Miami
	Ill.-S. W. Ind.	S. W. Indiana	Petersburg	Pike
	Mid-Continent	Oklahoma	Dewey-Bartlesville	Washington
1898	Appalachian	Pennsylvania	Bellevue	Allegheny
	Appalachian	Pennsylvania	Broadtree	Greene
	Appalachian	Pennsylvania	Imperial	Allegheny
	Appalachian	Pennsylvania	Plum Creek	Armstrong
	Appalachian	Pennsylvania	West Newton	Westmoreland
	Appalachian	C. & S. E. Ohio	Scio	Harrison
	Appalachian	C. & S. E. Ohio	Elk Run	Washington
	Appalachian	C. & S. E. Ohio	Flints Mills	Washington
	Appalachian	C. & S. E. Ohio	Mitchell	Washington
	Appalachian	West Virginia	Sedalia	Doddridge
	Appalachian	West Virginia	Arvilla	Pleasants
	Appalachian	West Virginia	Buffalo Run	Wetzel
	Appalachian	West Virginia	Folsom	Wetzel
	Appalachian	Kentucky	Burning Springs	Clay
	Lima-Indiana	N. W. Ohio	.....	Darke
	Lima-Indiana	N. W. Ohio	Van Buren Twp.	Shelby
	Lima-Indiana	N. E. Indiana	Erie Twp.	Miami
	California	California	Olinda	Orange
	California	California	Modelo	Ventura
	California	California	Temescal	Ventura
	California	California	Torrey Canyon	Ventura
	California	California	McKittrick	Kern
	California	California	Temblor	Kern
	California	California	Whittier	Los Angeles
1899	Appalachian	Pennsylvania	Ingomar	Allegheny
	Appalachian	Pennsylvania	Lagonda	Washington
	Appalachian	Pennsylvania	Lantz	Greene
	Appalachian	Pennsylvania	Moon Run	Allegheny
	Appalachian	Pennsylvania	Shellhammer	Armstrong
	Appalachian	C. & S. E. Ohio	Temperanceville	Belmont
	Appalachian	C. & S. E. Ohio	Wellsville	Columbiana
	Appalachian	C. & S. E. Ohio	Vaggi	Columbiana
	Appalachian	C. & S. E. Ohio	Philadelphia Road	Harrison
	Appalachian	C. & S. E. Ohio	Bowerston	Harrison
	Appalachian	C. & S. E. Ohio	Bricher	Harrison
	Appalachian	C. & S. E. Ohio	Maxwell	Harrison
	Appalachian	C. & S. E. Ohio	Lodi	Medina
	Appalachian	C. & S. E. Ohio	Moose Ridge	Monroe
	Appalachian	C. & S. E. Ohio	Whitacre	Monroe
	Appalachian	C. & S. E. Ohio	Goose Run	Washington
	Appalachian	C. & S. E. Ohio	Jackson	Vinton
	Appalachian	West Virginia	Stout	Doddridge
	Appalachian	West Virginia	Wallace	Doddridge
	Appalachian	West Virginia	Wallace	Harrison
	Appalachian	West Virginia	Wolf Summit	Harrison
	Appalachian	West Virginia	Kermit-Warfield	Mingo
	Appalachian	West Virginia	Spencer (Tanners Run)	Roane-Gilmer
	Appalachian	West Virginia	Hurricane	Roane
	Appalachian	West Virginia	Garner (Marion)	Wetzel
	Appalachian	West Virginia	Mills	Wetzel
	Lima-Indiana	N. E. Indiana	Blue Creek	Adams
	Lima-Indiana	N. E. Indiana	Rich Valley	Wabash
	Mid-Continent	Kansas	Chanute	Neosho
1900	Appalachian	Pennsylvania	Aleppo	Greene
	Appalachian	Pennsylvania	Aleppo	Armstrong
	Appalachian	Pennsylvania	Aten	Allegheny
	Appalachian	Pennsylvania	Bridgeville	Allegheny
	Appalachian	Pennsylvania	Carnegie	Allegheny
	Appalachian	Pennsylvania	Creekside	Indiana
	Appalachian	Pennsylvania	Deer Creek	Allegheny
	Appalachian	Pennsylvania	Forward	Allegheny
	Appalachian	Pennsylvania	Geneva	Armstrong
	Appalachian	Pennsylvania	Grapeville-Arona	Westmoreland
	Appalachian	Pennsylvania	Haddenville	Fayette
	Appalachian	Pennsylvania	Hammersley Fork	Clinton

(Continued on Next Page)

Year 1900	Province—	State—	Field—	County—
	Appalachian	Pennsylvania	Leechburg	Armstrong
	Appalachian	Pennsylvania	Linden	Washington
	Appalachian	Pennsylvania	New Castle	Lawrence
	Appalachian	Pennsylvania	Plum Twp.	Allegheny
	Appalachian	Pennsylvania	Rattlesnake Pool	Elk
	Appalachian	Pennsylvania	Ross	Washington
	Appalachian	Pennsylvania	Saltsburg	Westmoreland
	Appalachian	Pennsylvania	Sharon	Mercer
	Appalachian	Pennsylvania	St. Marys	Elk
	Appalachian	Pennsylvania	Zelienople	Butler
	Appalachian	C. & S. E. Ohio	Amsterdam	Carroll
	Appalachian	C. & S. E. Ohio	Homeworth	Columbiana
	Appalachian	C. & S. E. Ohio	Snyder	Harrison
	Appalachian	C. & S. E. Ohio	Port Homer	Jefferson
	Appalachian	C. & S. E. Ohio	Clift	Monroe
	Appalachian	C. & S. E. Ohio	Oakfield	Perry
	Appalachian	West Virginia	Salem	Harrison
	Appalachian	West Virginia	Copley	Lewis-Gilmer
	Appalachian	West Virginia	Benson	Lewis-Harrison
	Appalachian	West Virginia	Quaker Forks (Margaret)	Marion
	Appalachian	West Virginia	Twilight	Ohio
	Appalachian	West Virginia	Steel Run	Wetzel
	Appalachian	Kentucky	Lin Cooper	Wayne
	Appalachian	Kentucky	Darnell	Wayne
	Appalachian	Kentucky	Ragland	Bath
	Appalachian	Tennessee	Franklin County	Franklin
	Lima-Indiana	N. W. Ohio	Amanda Twp.	Hancock
	Lima-Indiana	N. E. Indiana	Jefferson	Adams
	Lima-Indiana	N. E. Indiana	Parker City	Randolph
	Mid-Continent	Kansas	Peru-Sedan	Chautauqua
	Rocky Mountain	Wyoming	Spring Valley	Uinta
	California	California	Wiley Canyon	Los Angeles
	California	California	Brea Canyon	Orange
	California	California	Midway-Sunset	Kern
	California	California	Kern River	Kern
1901	Appalachian	Pennsylvania	Delmont	West
	Appalachian	C. & S. E. Ohio	Germantown	Washington
	Appalachian	West Virginia	.....	Braxton
	Appalachian	West Virginia	Rosedale	Braxton
	Appalachian	West Virginia	Longshoal	Braxton
	Appalachian	West Virginia	Yellow Creek	Calhoun
	Appalachian	West Virginia	Sand Fork	Gilmer
	Appalachian	West Virginia	Stumptown	Gilmer
	Appalachian	West Virginia	Indian Fork	Gilmer
	Appalachian	West Virginia	Pohick	Wood
	Appalachian	Kentucky	Barbourville	Knox
	Appalachian	Kentucky	Ellington	Cumberland
	Appalachian	Kentucky	Knox County	Knox
	Appalachian	Kentucky	Menifee	Menifee
	Appalachian	Kentucky	Ravenna	Estill
	Appalachian	Kentucky	Sunnybrook	Wayne
	Lima-Indiana	N. W Ohio	Venedocia	Van Wert
	Ill.-S. W. Ind.	S. W. Indiana	Loogootee	Martin
	Mid-Continent	Oklahoma	Granite	Greer
	Mid-Continent	Oklahoma	Jenks	Tulsa
	Mid-Continent	Oklahoma	Red Fork	Tulsa
	Mid-Continent	Oklahoma	Tulsa	Tulsa
	Mid-Continent	Kansas	Humboldt	Allen
	Gulf Coast	Texas	Damon Mound	Brazoria
	Gulf Coast	Texas	Spindletop	Jefferson
	California	California	Timber Canyon	Ventura
	California	California	Midway	Kern
	California	California	Devils Den	Kern-Kings
	California	California	Santa Maria	Santa Barbara
1902	Appalachian	Pennsylvania	Unionville	Butler
	Appalachian	Pennsylvania	Zollarsville	Washington
	Appalachian	C. & S. E. Ohio	Plum Run	Harrison
	Appalachian	C. & S. E. Ohio	Sycamore	Monroe
	Appalachian	West Virginia	Newburne (Richardson)	Gilmer
	Appalachian	West Virginia	Rowles Run	Calhoun-Roane
	Appalachian	West Virginia	Curtisville	Marion
	Appalachian	West Virginia	Suckerrod	Brooke
	Appalachian	Kentucky	Clover Creek	Cumberland
	Appalachian	Kentucky	Dry Fork	Wayne
	Appalachian	Kentucky	Parmleyville	Wayne
	Appalachian	Kentucky	Wildwood	Allen
	Appalachian	Kentucky	Williamsburg	Whitley
	Lima-Indiana	N. W. Ohio	.....	Paulding
	Ill.-S. W. Ind.	S. W. Indiana	Birdseye	Dubois
	Mid-Continent	North Texas	Powell	Navarro
	Mid-Continent	Kansas	Bolton	Montgomery
	Mid-Continent	Kansas	Longton	Elk-Chautauqua
	Mid-Continent	Arkansas	Mansfield	Sebastian-Scott
	Gulf Coast	Texas	Hockley	Harris
	Gulf Coast	Texas	Sour Lake	Hardin
	Gulf Coast	Louisiana	Jennings	Acadia Parish
	Rocky Mountain	Colorado	Boulder	Boulder
	California	California	Salt Lake	Los Angeles
1903	Appalachian	West Virginia	Milton (Beckett)	Cabell
	Appalachian	West Virginia	Pitzer	Marion
	Appalachian	West Virginia	Silver Run	Ritchie
	Appalachian	Kentucky	Aratt	Cumberland
	Appalachian	Kentucky	Bear Creek	Cumberland
	Appalachian	Kentucky	Busseyville	Lawrence
	Appalachian	Kentucky	Compton	Wolfe
	Appalachian	Kentucky	Fallsburg	Lawrence
	Appalachian	Kentucky	Heard	Cumberland
	Appalachian	Kentucky	Irish Bottom	Cumberland
	Appalachian	Kentucky	Small	Cumberland
	Appalachian	Kentucky	Steubenville	Wayne
	Lima-Indiana	N. E. Indiana	Jackson Twp.	Allen
	Illinois-Indiana	S. W. Indiana	Taswell	Crawford
	Illinois-Indiana	S. W. Indiana	Princeton	Gibson
	Mid-Continent	Kansas	Alford	Chautauqua
	Mid-Continent	Kansas	Erie	Neosho
	Mid-Continent	Kansas	Gas City	Allen
	Mid-Continent	Kansas	Tyro	Montgomery
	Gulf Coast	Louisiana	Batson	Hardin
	Gulf Coast	Texas	Ansela Butte	St. Martin
	Gulf Coast	Texas	Saratoga	Hardin
	Gulf Coast	Louisiana	Welsh	Jefferson Davis Parish
1904	Appalachian	Pennsylvania	Mount Jackson	Lawrence
	Appalachian	West Virginia	Chester	Hancock
	Appalachian	West Virginia	Moscow	Hancock
	Appalachian	West Virginia	Majorsville	Marshall
	Appalachian	West Virginia	Grandstaff Run	Marshall
	Appalachian	Kentucky	Menifee County	Menifee
	Illinois-Indiana	Illinois	Casey	Clark
	Mid-Continent	Oklahoma	Aluewe	Nowata
	Mid-Continent	Oklahoma	Avant	Osage
	Mid-Continent	Oklahoma	Belmont	Osage
	Mid-Continent	Oklahoma	Chicken Farm	Muskogee
	Mid-Continent	Oklahoma	Claremore	Rogers
	Mid-Continent	Oklahoma	Cleveland (Osage)	Pawnee
	Mid-Continent	Oklahoma	Coody's Bluff	Nowata
	Mid-Continent	Oklahoma	Lawton	Comanche
	Mid-Continent	Oklahoma	Lenepah	Nowata
	Mid-Continent	Oklahoma	Muskogee	Muskogee
	Mid-Continent	Oklahoma	Okesa	Osage
	Mid-Continent	Oklahoma	Wheeler	Carter
	Mid-Continent	Oklahoma	Wiser	Osage
	Mid-Continent	North Texas	Petrolia	Clay
	Mid-Continent	North Texas	South Bosque	McLennan
	Mid-Continent	Kansas	North	Allen
	Mid-Continent	Kansas	Pottawatomie Valley	Anderson
	Mid-Continent	Kansas	Rantoul	Franklin
	Mid-Continent	Arkansas	Massard Prairie	Sebastian
	Gulf Coast	Texas	Humble	Harris

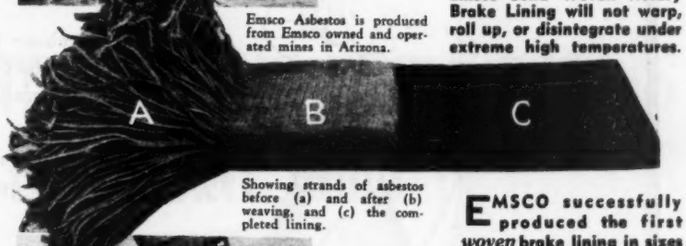
THE FIRST *Woven Rotary* BRAKE LINING

larger than 5/8" in thickness



Emsco Asbestos is produced from Emsco owned and operated mines in Arizona.

Emsco Solid Woven Rotary Brake Lining will not warp, roll up, or disintegrate under extreme high temperatures.



Showing strands of asbestos before (a) and after (b) weaving, and (c) the completed lining.

The first loom to successfully weave brake lining larger than 5/8" thick was designed, built and used by us in our own plant.

EMSCO successfully produced the first *woven* brake lining in sizes larger than 5/8" thickness.

For more than twenty years Emsco has pioneered and produced the most outstanding brake lining for heavy duty service.

Its uniform high quality and unequalled performance are due to complete control of quality and manufacture from raw materials to finished product.

Emsco Solid Woven Rotary Brake Lining was used on the deepest, as well as the second and third deepest oil wells in the world; and many others among the famous wells of petroleum history. We are proud that Emsco was selected because of its sureness and dependability in braking action.

EMSCO ASBESTOS COMPANY
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The finished Emsco Solid Woven Rotary Brake Block.

EMSCO SOLID WOVEN ROTARY BRAKE LINING

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PIPELINE OPERATION
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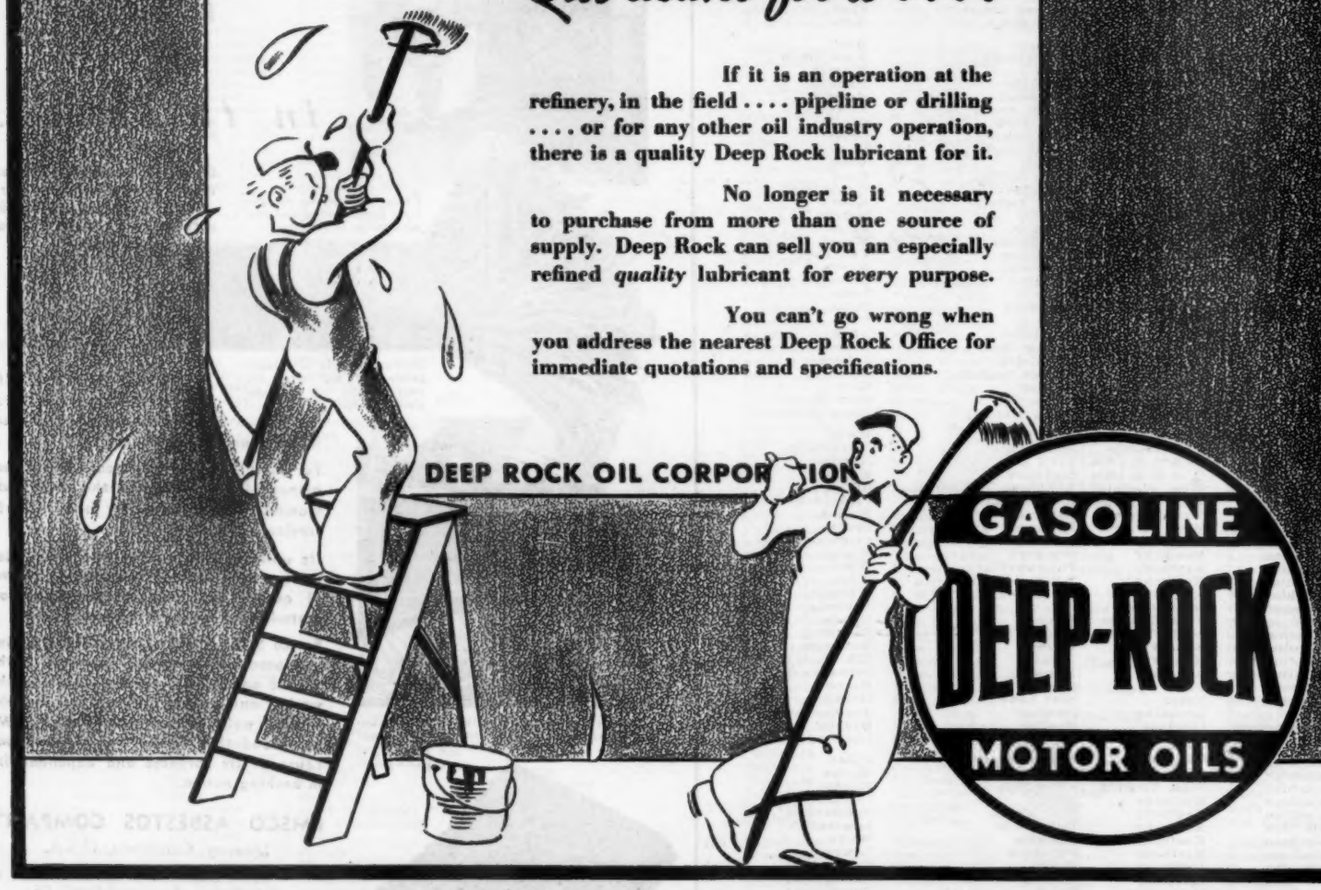

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First refinery crew in California at Santa Paula refinery of Union Oil Co.

LARGEST REFINERY CENTER IN WORLD GOT ITS START IN THIRD ERA; PLANT BUILT IN KANSAS

REFINING—ERA NUMBER 3 1889-1904

Early in the period extending from 1889 to 1904, petroleum refining made its entry as an industry of the Southwest. The Standard Oil Co. of Kansas in 1889 decided to build a small skimming plant to handle the crude oil which had become available from the Thayer pools in Neosho County and near Neodesha where the plant was located. This plant was the first to be built in what later came to be known as the Mid-Continent area. The plant was reported operating in 1890 making kerosene which was distributed by the Standard Oil Co. in Kansas, Missouri, and Oklahoma Territory.

About a year later, competition developed for the Standard refinery when C. D. Webster and associates built a 300-bbl. plant at Humboldt, Kans., in Allen County. Within a few years, several small plants were built at Chanute, Erie, and Cherryvale. All of these plants, with the exception of the Standard refinery at Neodesha, now owned by the Standard Oil Co. (Indiana), have since been dismantled. Refinery growth in Kansas was confined to these few plants for several years. The Corsicana Refining Co., in 1898 built a plant at Corsicana, Tex. Crude oil had been discovered in that area previously and producers had difficulty disposing of the crude at profitable prices. J. S. Cullinan in 1898 organized the Corsicana company and built the plant. E. R. Brown was in charge of construction and later operated the refinery as superintendent. This plant later became the property of the Magnolia Petroleum Co. and Mr. Brown continued with the company and is chairman of the board at this time.

Shortly thereafter the first plant construction was reported in the Gulf Coast, the area which is now the largest refining center in the petroleum world. The refinery of the Magnolia Petroleum Co. at Beaumont, Tex., was built in 1902. The following year the United Oil & Refining Co. built a refinery at Beaumont. The present refinery of the Gulf Refining Co. at Port Arthur, Tex., had its beginning in 1901. In 1902, the Texas Co. started building its first plant at Port Arthur, Tex., and the refinery which is now the largest of the company's several plants, started operating in 1903.

Out on the Pacific Coast, petroleum refining was gradually expanding. The present plant of the Union Oil Co. at Oleum, Calif., was built in 1895. The Gaviota, Calif., refinery of the Associated Oil Co. was first built in 1889. In 1902, the Standard Oil Co. of California built the largest refinery on the West Coast at Port Richmond (San Francisco), Calif. This plant now has a rated crude oil capacity of 100,000 bbls. daily.

In 1890 the Standard Oil Co. (Indiana) had completed its initial installations at Whiting, Ind., and the refinery was operating. This refinery was connected by pipe line to the Lima Field, Ohio, and later also secured crude supplies from the new fields of Indiana and Illinois.

Refining Widely Scattered

Thus by 1902, petroleum refining was established in all areas in which it has since become an important industrial enterprise. In the older refining areas, several companies which are now known as major refining organizations, had already become operators of what at that time were considered large sized plants handling from 5,000 to 15,000 bbls. of crude oil daily.

Considerable was heard of the new developments at the Philadelphia and Pittsburgh, Pa., refineries of the Atlantic Refining Co. The former had been established in 1866 and the latter in 1862. At Bayonne, N. J., the refinery of the Tide Water Oil Co., first built in 1879, had become one of the most complete refineries in the oil business. The Standard of New Jersey at Parkersburg, W. Va., was another important operating unit.

It was estimated during this period that the Standard Oil trust owned directly or controlled at least 85 per cent of the refining capacity in the United States. However, the operations of several refining units were largely independent and new developments in construction and operation varied depending on character of crude oil supplies, capacities and products refined. Some plants specialized in the manufacture of lubricating oil and by-products while others were designed to give a large production of light oils.

Pennsylvania Group

The so-called independent operators continued among those refineries located in Pennsylvania near the oil fields. They were constantly endeavoring to offset the advantages of the Standard refineries with their pipe line and water transportation facilities. In 1892 a group of these independent refiners started to build the United States Pipe Line to the seaboard for the transportation of kerosene. This line was completed to Wilkes-Barre, Pa., June 24, 1893, and was operated for several years, enabling the inland refiners to make their kerosene production available at the Atlantic Seaboard over the Jersey Central Railroad from Wilkes-Barre, for export movement at costs comparable to the seaboard refineries connected to the interior with crude oil pipe lines. It is claimed that line prevented several plants from being shut down permanently.

In 1886, the Penn Refining Co. built a refinery at Rouseville, Pa., and the same year the Nonpareil Refining Co. built a plant adjoining it. The latter plant was owned by the Valley Refining Co. and in 1893 was purchased by the Germania Refining Co. In 1914 this company took over the Penn Refining Co. These properties are now owned by the present Pennzoil Co.

Technical Developments

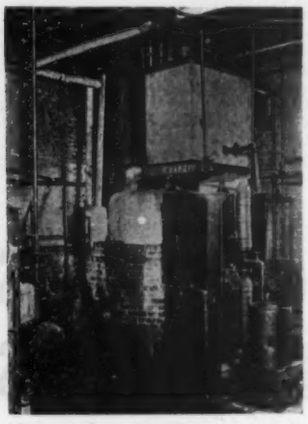
This period was marked with important advancements along technical lines covering research and development aimed to improve refinery processing methods and widen the demand for petroleum

Corsicana, Tex., refinery of Magnolia Petroleum Co. under construction. This was the first refinery to be built in the Group 3 area and the second one west of the Mississippi River

products. It is no exaggeration to state that the work started at this time led to the practical developments in the art of cracking and many other innovations in construction and operation of great value to the industry over the past 25 years.

In 1889, Dr. W. M. Burton, recently graduated from Johns Hopkins University with a Doctor of Philosophy degree, joined the Standard of Ohio refinery organization at Cleveland, Ohio. His first work was to investigate the cause of pin holes in can bottoms. He found this to be caused by the improper neutralization of acid left in the oil in refinery treatment.

In 1890 he was sent to the company's new refinery at Whiting, Ind. The status of the petroleum chemist in the refining industry at that time is indicated in the question, "Have you your kit with you?" asked by the vice president of the company in charge of the refinery when Doctor Burton reported to him for work. The plant executive apparently classified



First laboratory Burton cracking still

him as a skilled mechanic similar to the carpenters, bricklayers and others who were building the plant at that time.

He gave Doctor Burton two bedrooms in a vacant farm house on the plant site for his first laboratory. His achievements and those of other chemists in aiding in the solution of many problems connected with the refining of Lima and other new crudes soon attracted the attention of executives and in a short time, the Whiting refinery had one of the largest, if not the largest, laboratories of the refining industry. To carry on experimental work, a 100-gallon still was built for crude distillation and one for copper oxide distillation. The laboratory also had a small steam still and an agitator for semicommercial testing. The experimental work with these stills played an important part in the design of the main features of the refinery.

In 1896, the management of the company was so impressed with the value of its laboratory that it authorized the construction of a brick building to be used exclusively for testing and experimental work. It is said that this was the most complete of its kind at that time. However, reports on the operations of other large refineries show that in most cases they had established laboratories and were devising means to improve the efficiency of their plants' operations. Doctor Burton advanced rapidly in the manufacturing department of the Indiana Standard and was its president at the time of his retirement. His outstanding contribution to the art of refining—that of placing cracking on a commercial basis—came in a later period than is discussed here.

Definite Accomplishments

Dr. R. E. Humphreys, who was vice president in charge of manufacturing for the Standard Oil Co. (Indiana) at the time of his retirement a few years ago, joined the company one year later than Doctor Burton, as a chemist. His first job was in the nature of research work. He was asked to make a combustion test of a sample of "stove" gasoline to determine the percentage of carbon and hydrogen. Doctor Humphrey in later years told of some of the laboratory work carried on the first few years he was in the company's laboratory. These included:

Devising methods of making useful asphalt products from the plant sludges resulting from the treatment of reduced crudes.

Making road asphalts by oxidation of crude residues.

Working out new methods of manufacturing greases and producing bloomless oils.

Producing candles having the appearance and odor of beeswax.

Filtering and settling of steam refined oil in naphtha solutions.

The most ambitious program was the production of hydroxystearic acid from oleic acid. The latter is obtained as an ester in mixed oils and is secured by saponification with an alkali. It was a drug on the market at that time. It was proposed to use the new acid in place of stearic acid for stiffening wax candles. A large scale plant was built and operated for a time. It was not a complete commercial success and was later shut down and dismantled.

The literature of the time tells of a great amount of other work under way at refineries and private laboratories. A fact often overlooked is that many of these experiments were failures so far as commercial developments were concerned. Many millions of dollars were spent in this and later periods in research and development work which failed in its objective to give the industry some tangible development of practical value.

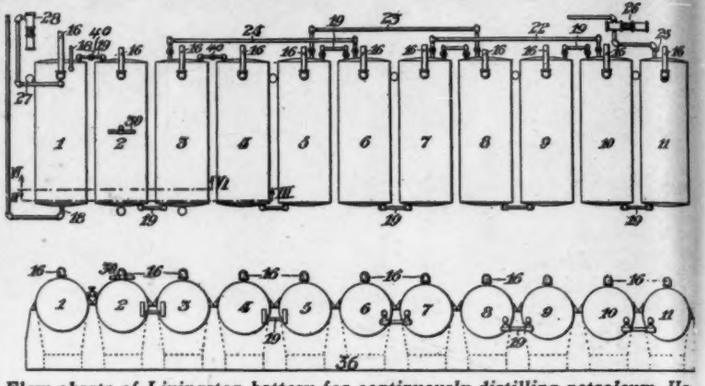
There were several innovations in fractionation during this period. Operators without any of the fundamental data now available to guide them began the "trial and error" method of devising means to secure a closer separation of products. It is said that Hermann Frasch who as previously explained in an earlier period is given the main credit for devising a satisfactory method of treating distillates from the high sulphur Lima crude oils, about 1898, designed a still using vacuum distillation and a bell cap type of bubble tower. This design was offered to the Standard Oil Co. but the latter had become interested in a type of stone-packed tower which started to come into the industry about 1896 and the company refused to accept the Frasch equipment. Frasch had become familiar with the work of Professor Heckmann in Germany who about 1870 had designed a bubble cap tower for refining cleaners' naphthas. In this connection experimental work was being done in fractionating based on ideas borrowed from the liquor distilling industry both in the United States and foreign countries. The practical application of these ideas, however, did not become apparent in petroleum refining until a later period.

Continuous Distillation

Possibly the most important development of this period from a practical standpoint was the greater application of continuous operation in distilling crude oil. In 1899, Max Livingston, of the Atlantic Refining Co., is given credit for perfecting the continuous operation for fire stills in a battery installed at the Point Breeze (Philadelphia) refinery of the Atlantic Refining Co. As previously explained the start of continuous distillation unquestionably belongs to the previous period for there were types of continuous stills in operation at refineries in the United States and foreign countries at that time.

Livingston Battery

The Livingston application differed from those which preceded it and was adaptable to large scale operations which were coming into the industry at this time. It was quickly adopted by other refiners and for that reason it deserves to be ranked as one of the most important commercial developments of the refining industry. The main features of the Livingston battery are shown in the accompanying diagram. The following description of this battery appears in "American Petroleum Industry," by Bacon and Hamor:



Flow charts of Livingston battery for continuously distilling petroleum. Upper: A view in top plan of stills arranged in accordance with a good form of Livingston design. Lower: A view in front elevation of the stills shown above

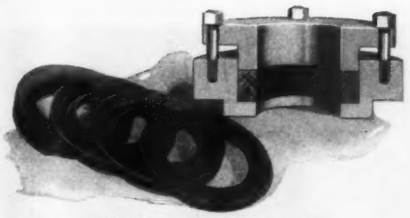
"In the diagram are the stills of a series (1 to 11) shown as arranged side by side on a foundation of masonry (36), which embodies a series of fire chambers, one situated beneath each still. Each still with its fire chamber, is structurally independent of every other except for the connections. Each still is preferably formed as a cylindrical vessel of sheet iron and placed upon its side across the top of its associated fire chamber. At the back of the fire chambers of the first two stills of the series after No. 1 are arranged uptakes discharging into a series of flues which extend through the bodies of said stills Nos. 2 and 3 and discharge within the smoke boxes each of which is common to the group of flues of a single still from which boxes lead suitable smoke stacks.

"The remaining stills of the series may

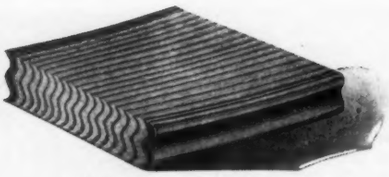
Barge and tank shipments provided the principal outlet for the products of Gulf Coast refiners. In the foreground is the loading dock and barges of the Gulf Refining Co. at Port Arthur, Tex., in the background is a start of what is now the company's 125,000-bbl. complete refinery

Increase Operating Efficiency...

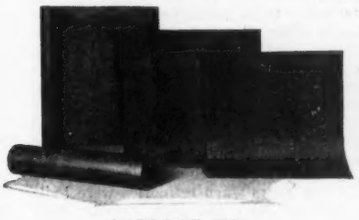
with these GARLOCK Money Savers!



GARLOCK Chevron Packing



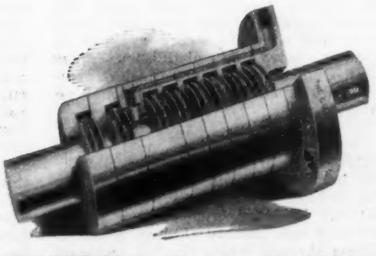
GARLOCK Guardian Gasket (Cross-Section View)



GARLOCK 7021 Compressed Asbestos Sheet Packing

GARLOCK 400 Slush Pump Packing

GARLOCK 7050-C Shredded Metal Packing



GARLOCK 875 Gas Compressor Metal Packing

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be provided at the backs of the fire chambers with any suitable smoke stacks or other conveyors for the products of combustion by which the latter are discharged at any suitable point or utilized in any desired manner. The passage of the smoke and products of combustion through the flues within the bodies of the stills Nos. 2 and 3 of course aids in elevating the temperature of the oil in said stills and thus economizes fuel. Nos. 16 are vapor lines leading from the stills and through which the vapors of distillates are conducted to suitable condensers and collecting tanks. Still No. 1 which is termed the preparatory still is provided with an internal steam or other heating coil, the supply and discharge pipes 18 of which pass through the shell of the still and through which oil is charged steam or hot fluid from any suitable source.

"Referring to the pipe connections and especially to the construction shown in chart, each pipe connection is connective of two adjoining stills and which connections are herein termed the short connections, is as to the portion of it which exists outside of the stills, of approximately U-shaped form, to constitute a suitable trap, such U-shaped portion being designated 19; and from the respective side members of such portion 19, branches lead to the interior of the two stills connected, such branches being provided within the respective stills with elbows and risers which regulate the liquid level, or capacity, within each still."

Single Operation

The operation of the still is indicated from this description of the unit. As in other types of construction the operation essentially consists in charging the crude to the first still. It then passes through the other stills connected in series and finally after all the desired overhead distillates have been removed the residuum is pumped from the last still. Higher temperatures are maintained in each successive still. Distillates of successively higher boiling ranges are taken from the condensers connected to the vapor lines of the several stills.

This type of distillation found favor in a few years when refineries were built to operate with the high gravity Mid-Continent crudes where the main operations consisted in removing the overhead distillates extending from gasoline to gas oil. Refiners found that several of their 300 to 500-bbl. batch stills hooked up for continuous operation gave them a much larger capacity, reduced fuel and labor costs and simplified the control of the finished products. After some test operations most refiners were able to operate their units to secure a series of products based on distillation range which could be made into finished products with a minimum of additional refining.

Heat Exchange

This type of operation was quickly tied in with various arrangements for heat exchange. Exchangers were built so that the incoming crude charge to the first still was pumped through a coil in a drum through which the hot residuum from the last still was allowed to gravitate or was forced with a pump. Thus heat was saved which had been entirely lost in the previous batch stills with their intermittent operation. Writers of that time also state that continuous distillation served to stimulate interest in fractionation. Various types of aerial towers were built and with the aid of continuous distillation closer fractionation was obtained. A design of that time shows the liquid knock-back in a shell tower being dropped back into the next still instead of the same still. This progress in fractionation in a later period was to minimize the necessity of continuous distillation through the recovery of several products in one distillation.

As a development along these lines William Irish and John Van Dyke of the Atlantic Refining Co., in 1904, developed an air-cooled, stone-packed tower which distilled crude oil to coke in a single operation. A number of these units were built.

Although they did not receive much attention at the time nor since, there were reports of developments along engineering lines that were a contribution to refinery practice at the time, some of which are still in constant use. In 1893, George H. Taber, who later became vice president in charge of manufacturing for the Gulf Refining Co., used fuller's earth in place of animal charcoal. Before the end of the century it was in common use. George M. Saybolt, of the Standard Oil Co., was using a fine clay to remove flock from kerosene. He was issued a patent in 1896. There were numerous other developments reported.

Capacity Expands

During this entire period, refinery capacity showed a steady increase, the gain being especially marked during the last five years. In 1890 according to available figures the crude runs to stills at refineries in the United States averaged about 90,000 bbls. daily. By 1900 this had increased to approximately 160,000 bbls. daily and by 1904 this figure had almost been doubled with refineries averaging approximately 300,000 bbls. of crude to their stills. Although an accurate check is not available it does not appear that there was much of an increase in the number of refineries during this entire period. This in effect means that the enlarged capacity was provided for by enlarging the plants already in operation.

Marketing conditions were on a more stable basis although the depression years of 1893 and 1894 were reflected in low prices which brought many complaints from refiners. Prices improved materially in 1896 and this situation with minor changes continued until 1904. Kerosene was still the main product of these refineries. However, gasoline had been placed on the market for motor cars but the records of the times do not indicate that the industry realized the significance of this development.

KEPT OIL FORTUNE IN HIS HOUSE AND—

Oil found on John Benninghoff's farm on Benninghoff Run, near Petroleum Center, Pa., made him suddenly wealthy. Distrustful of banks, he stored almost half a million dollars in a cheap safe in his sitting-room. On the night of January 16, 1868, robbers entered his home, bound the inmates, had a luncheon of pie and milk and then rode away with $210,000 in cash and bonds. They overlooked $200,000 wrapped in brown paper. Three men, convicted of complicity, served short penitentiary terms. Jim Saeger, of Saegertown, Pa., handsome and popular, left his usual haunts soon afterward.

Three years later a western cattle king entered a saloon in Denver, Colo., to treat a party of friends. The bartender, formerly of Meadville, Pa., recognized him as Jim Saeger. He telegraphed East, and Chief of Police Rouse, of Titusville, started at once for Denver with Joseph Benninghoff, a son of the man robbed. Extradition papers were obtained and Saeger was arrested.

"You'll be a hell of a sight older before you see me in Pennsylvania," the accused man said. A small army of Saeger's cowboys —reckless, lawless fellows—were in the city. Rouse and Benninghoff returned home without their prisoner. Saeger lived for years afterward a prosperous cattleman in Texas, known for his generosity to those in need.

—o-O-o—

DOCTOR BURTON REVIEWS EARLY DIFFICULTIES AT WHITING IN DEVELOPING THE FIRST COMMERCIAL CRACKING UNIT

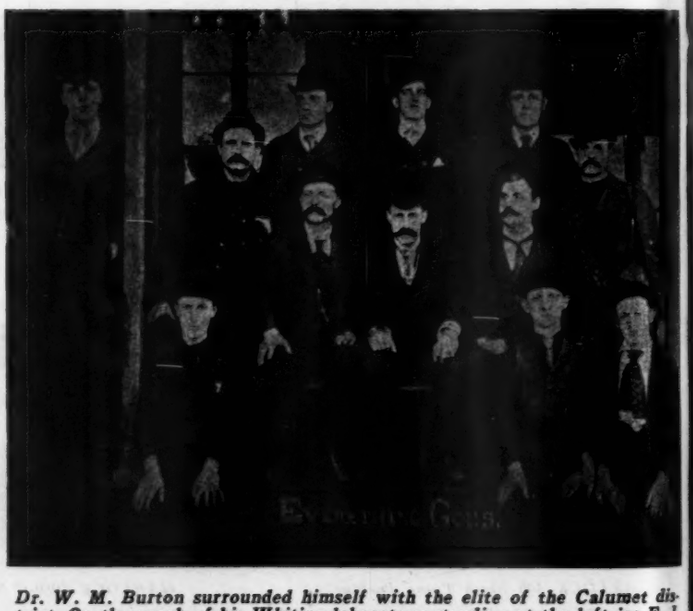
By DR. W. M. BURTON

Our first experiments were directed toward making a suitable product by superheating the high-boiling vapors as such, but without pressure, somewhat along the practice observed in making Pintsch gas. We soon found, however, that this so-called "cracking" in the vapor phase required a temperature so high that the aliphatic hydrocarbons contained in the petroleum were largely converted into cyclic and aromatic bodies and fixed gases, unsuited for our purpose. The yield was poor and the quality most undesirable. Obviously our problem included the proposition of reducing the molecular weight without changing the general structure.

We next tried the use of various reagents and catalyzers, such as aluminum chloride and ferric oxide. Anhydrous aluminum chloride, indeed, produced some rather remarkable results. The yield and quality of naphtha products were fairly satisfactory, but there was a substantial loss of oil in the operations, and the first cost of the anhydrous aluminum chloride, as well as the difficulty in recovering it from the residues, rendered this plan unattractive.

Nearly 30 years ago Sir Boverton Redwood and Professor Dewar in England patented a pressure distilling process for the purpose of increasing the yield of kerosene oil from the residues of Russian crude petroleum, but it never was applied industrially. It has been known, therefore, for some years that distilling petroleum under pressure served to break down the high-boiling fractions into low-boiling fractions, but, as far as we could learn, no one had ever done it on the large scale and, in fact, such a proposition could not commend itself to a practical refiner because of the obvious dangers from explosions and fires.

But having tried everything that suggested itself, we attacked the problem of distilling petroleum in considerable quantities (8,000 to 12,000 gallons) under pressure of about 5 atmospheres. Our first still was of a welded design and was planned to handle 100 gallons of the high-boiling fractions. Obviously, the raw material first to be tried consisted of the so-called fuel oil, or reduced crude, meaning the residue of crude oil after the more valuable products had been removed. We soon found that we could not work profitably with this product; when distilled with or without pressure it produced quantities of coke that deposited on the bottom of the still and caused a red-hot bottom that would not stand any rise in pressure. The next proposition comprised the use of high-boiling distillates from the crude, viz., oils boiling from 225° C. upwards. We distilled these distillates at a pressure of about 5 atmospheres and were charging 8,000 gallons of raw material. Considerable argument was required to convince any of our directors that such a revolutionary proposition could possibly be successful, but finally they voted in favor of it, and we went ahead.



Dr. W. M. Burton surrounded himself with the elite of the Calumet district. On the porch of his Whiting laboratory standing at the left is: E. J. Uhler, chemist. Three standing in the rear are: F. B. Lewis, assistant to Dr. Burton, A. E. Gladden, oil inspector, and J. P. Freeman, foreman. The five wearing the groomed hirsute adornments are: J. A. Gill, head treater, W. S. Rhem, superintendent, Dr. Burton, then chief chemist, U. G. Swarts, chief clerk and J. B. Moore, refinery foreman. The gentlemen in the foreground are: W. O. Walker, sample boy, William Zimmerman, telephone operator and W. D. Rial, messenger boy extraordinary

We had solved the big points, but there were many smaller ones. For successful results we must operate with the oil at temperatures from 370° to 400° C. in the still. At 450° C. steel begins to lose its tensile strength and its capacity to withstand pressure. It is clear, therefore, that with this narrow margin great caution must be exercised to prevent overheating. The human element enters here, as it does in every feature of pressure still operation, but we operated over eight years with hundreds of these stills in daily use, and manufactured millions of barrels of gasoline by this method before we had a fatal accident.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1931

RAPID ADDITION OF LARGE OIL AREAS IN THE THIRD PERIOD CAUSED A GENERALLY LOW CRUDE PRICE RANGE

PRICES—ERA NUMBER 3 1889-1904

The third 15-year period of the oil industry saw marvelous advances and numerous changes in the production end of the business. At its start, January 1, 1889, Pennsylvania led all other states in production but at its close, December 31, 1903, California was the leading producing state, with Ohio second, Texas third, West Virginia fourth and Pennsylvania was relegated to fifth place. In total production for 15 years Ohio led, with Pennsylvania second, West Virginia third and California fourth. Pennsylvania, West Virginia and Ohio had seen their peak production days, while Illinois, Indiana and Kentucky east of the Mississippi, and all the producing states west of the river were on the way to greater production.

This third era of the industry saw the development and peak production of West Virginia, 16,196,000 bbls., in 1900; and Ohio, 23,941,000 bbls. in 1896. The big Lima field, opened in 1885, rose to its greatest heights in this era. The Corsicana, Texas, field was discovered and the Texas Coastal fields were opened with the marvelous Spindletop pool near Beaumont as a starter. The first production was recorded in Kansas, Oklahoma, Louisiana and Wyoming. Illinois was producing a little oil but its heyday was a thing of the fourth 15 years. Following the Bradford field no other big fields were opened in Pennsylvania and the production of the state and New York state steadily declined.

So many new fields were opened in the third era that the price of oil was kept down. It fell even lower on an average than in the 1874-1888 period.

The average price of crude oil in the third 15 years was 84.8 cents per barrel. In all the years from 1889 to 1903, both inclusive, value of the oil never rose above $1.10 per barrel (in 1900) as an average for a year, and it fell as low as 51 cents (in 1892) Pennsylvania high grade oil fell to 50 cents per barrel on October 28 and 31, 1892. In the course of the 15 years production was recorded in New York, Pennsylvania, West Virginia, Ohio, Indiana, Kentucky, Illinois, Kansas, Oklahoma, Texas, Louisiana, Wyoming, Colorado and California. In that period those states produced in the following quantities:

Production By States 1889-1903

State—	Years	Bbls.
Ohio	15	286,174,000
Pennsylvania	15	276,675,000
West Virginia	15	139,813,000
California	15	62,237,000
Indiana	15	55,022,000
Texas	8	42,552,000
New York	15	17,445,000
Colorado	15	6,963,000
Kansas	15	1,965,000
Louisiana	3	1,467,000
Kentucky-Tennessee	15	999,000
Oklahoma	7	193,000
Wyoming	10	51,000
Illinois	15	6,000
Scattered	4	8,000
Total United States		892,572,000

The Great Lima Field

While a well drilled for oil in the Macksburg area in Southeastern Ohio in 1860 found oil, it was 1876 before there was enough production in the state to warrant a record being kept. From 1889 to 1903, both inclusive, the state produced 286,174,000 bbls. of crude oil, the bulk of it coming from the Lima Field in Northwestern Ohio, where the discovery well was drilled by Ben C. Faurot on his paper mill property at Lima on May 9, 1885. In 1889 the field produced 12,153,189 bbls. reaching a peak production of 20,575,138 bbls. or about 56,000 bbls. per day, in 1896. By the end of the century, 1900, the field was down to 17,375,514 bbls. The Southeastern Ohio fields produced a high gravity "sweet" crude. The Lima Field produced a lower gravity "sour" crude. Its sulphur content was high. A chemist appeared with a process for sweetening the oil so that it could be converted into good illuminating oil without a sign of its original "rotten egg" smell, and the Lima fields became a very important link in the industrial chain.

The Lima Field eventually covered parts of 20 counties. Wood County was the richest in oil production. Wells from 1,000 bbls. upward in initial production were common in Wood County in the flush days of the field. Over 15,000 wells were drilled in that county. Hancock and Sandusky Counties followed in importance.

Lima oil which sold for 15 cents per barrel in the early years of the field reached a price of $1.27 for North Lima and $1.25 for South Lima in April 1895, after the crude had been made refinable by the extraction of the sulphur. Indiana crude which was also a Trenton Rock product and high in sulphur carried about the same price as the oil from Lima Field. In 1887 the first oil was run by pipe line from the Lima Field. The Buckeye Pipe Line Co. ran 75 per cent of it during the 15-year period.

Corsicana and Spindletop

The first commercial oil field in Texas was opened near Corsicana in 1896. Down to the end of 1903 Northern Texas produced 4,038,000 bbls. of oil at an average price of 79 cents per barrel. The Spindletop pool in Coastal Texas started a drilling boom which resulted in large production and in 1901, '02 and '03 the Coastal region produced 38,514,000 bbls. of low gravity oil then classified as fuel oil, for which the producers received an average of 29 cents per barrel. The average price in 1901 was 18 cents; in 1902, 21 cents and in 1903, 41 cents. Previous to Spindletop what little oil was produced in the Gulf field (and it amounted to less than 1,000 bbls. a year) brought high prices ranging from $4.20 to $7.02 per barrel. In 1902 the Coastal field produced over 20 per cent of the country's crude output.

California Overproduced

Californians, who had received a fine price for their oil in the second 15-year period were made to suffer like their eastern brothers for the sin of overproduction. The second period closed with a yearly average of $2.01 per barrel. The average for the first year of the third period, 1889, was $1.17 per barrel. In the closing year, 1903, it had fallen to an average of 30 cents per barrel. That year was its peak production year for the third 15-year period. It had increased its output from 303,000 bbls. in 1889 to 24,382,000 bbls. in 1903. In the 15 years the state's production was 63,237,000 bbls. valued at $32,687,000 or an average over the whole period of 51.7 cents per barrel.

Rocky Mountain Prices

Wyoming did not produce much oil in the third period, 51,000 bbls., but the producers received $357,000 for it, or an average of $7 per barrel. Colorado producers were paid $6,377,000 for 6,963,000 bbls. of oil or an average of 91.6 cents per barrel. The market averaged above $1 in 1890 and 1900 and averaged an even dollar in 1901. It went up to $1.23 as an average for 1902, but fell below the dollar mark again in the last year of the period. The oil graded 34.8 to 37 degrees in gravity and was of paraffin base. It came from shale beds, penetrated by the drill in the Florence area. The Boulder pool was opened in 1902 and produced from sand. These were the only pools in the state in the period.

Louisiana producers received $605,000 for their 1,467,000 bbls. production in 1902 and 1903, or an average of 41 cents per barrel.

Oklahoma produced 193,000 bbls. for which producers received $193,000, or an average of $1 per barrel. Kansas producers realized a gross revenue of $1,788,000 for 1,964,000 bbls. of oil, or 91 cents per barrel over the 15 years.

Wide Spread in Eastern Prices.

In the Pennsylvania grade fields the third period of the industry was one of widely separated top and bottom prices. The market fell to 50 cents per barrel in 1892, as before stated, but the period closed in 1903 with the average value of the crude produced very close to $1.60 per barrel. This covered the New York, Pennsylvania, West Virginia and Southeastern Ohio fields. For the whole 15-year period the average price was 97.5 cents. This was for the best grade of crude in the world.

While the great shut down movement in the Pennsylvania fields was started in 1884 by John P. Zane, of Bradford, who circulated a petition asking producers to shut down their producing properties until January 1, 1885, it was not until October 31, 1887, at a conference between representatives of the Producers Protective Association and the Standard Oil Co. that anything definite was done about it. A meeting was held in Oil City at which time producers signed up to partly shut in their producton for one year. The Bradford Field had produced 19,000,000 bbls. in 1886, but in 1887 so complete was the response to the shut down movement that only 7,700,000 bbls. was produced. The shut down continued in 1888 and production fell to 5,400,000 bbls. that year. Other pools responded in the degree in which they produced.

Shut-In Movement

From this shut-in movement producers were to receive the benefit which might accrue from the advance in the price of 5,000,000 bbls. of oil set aside at 62 cents per barrel, the profit on the oil to be divided proportionately to the amount of production which each operator shut in. Out of the 5,000,000 bbls. the producers were to give the profit on 1,000,000 bbls. to their workmen and the Standard Oil Co., buyers of the oil, set aside another 1,000,000 bbls. for the same purpose. Many producers agreed not to drill any more wells during the 12 months.

It was in the third period of the industry, or on June 20, 1889, that the Standard Oil Co. purchased 3,500,000 bbls. of the 5,000,000 bbls. at 91½ cents per barrel giving a profit of $248,000 to the producers.

The pecuniary results of the shut down were not as great as the producers had hoped for, but the Association accomplished the purpose of the organization which was to reduce crude stocks. Further than that they made a profit out of the oil which had been set apart without any expense to themselves for their own use in case they kept their agreement inviolate. The large volume of oil set aside for the support of the workmen had previously been purchased by the Standard Oil Co. and the money distributed among the men. Thus ended the first great shut down movement.

Production and Value of Oil Produced in United States in Third 15 Years

Year	Quantity	Value at well	Ave. per bbl
1889	35,164,000	$26,963,000	$ .77
1890	45,824,000	35,365,000	.77
1891	54,293,000	30,527,000	.56
1892	50,515,000	25,907,000	.51
1893	48,431,000	28,950,000	.60
1894	43,344,000	35,522,000	.72
1895	52,892,000	57,632,000	1.09
1896	60,900,000	58,150,000	.96
1897	60,476,000	40,874,000	.68
1898	55,364,000	44,193,000	.80
1899	57,071,000	64,604,000	1.13
1900	63,621,000	75,989,000	1.19
1901	69,389,000	66,417,000	.96
1902	88,767,000	71,179,000	.80
1903	100,461,000	94,694,000	.94
Total	892,572,000	$757,335,000	$0.848

OF COURSE IT DIDN'T PUT FLAMES OUT

They were trying to extinguish a fire in the United States Hotel in Pithole in the early part of 1866, using water from a nearby well. It was discovered that the liquid instead of quenching the flames seemed to be feeding them. Investigation disclosed that the well from which the water was obtained was covered with a layer of oil several inches thick. So the volunteer firefighters went elsewhere for their water.

It was found then that oil was running into other water wells in the neighborhood too. Excitement followed. Thousands went to see these strange wells and large prices were offered for them. Several springs in the vicinity were found to be yielding oil also.

The original water-and-oil well was only 16 feet deep and more than 50 bbls. of oil was taken from it with a common pump. Another well, 23 feet deep, gave up more than 100 bbls. of oil. Land owners dug wells of moderate depth and some of them got oil. One at a depth of only 12 feet struck a crevice in the surface rock, from which flowed a fine stream of oil.

All these wells were 150 feet above the level of Oil Creek and a half-mile from where producing oil wells were being drilled. Various theories were offered. Then the real explanation was discovered. The pipe line from Pithole to the Miller Farm on Oil Creek had sprung a leak and oil thus lost was running into water wells in the neighborhood.

AIRCO salutes the
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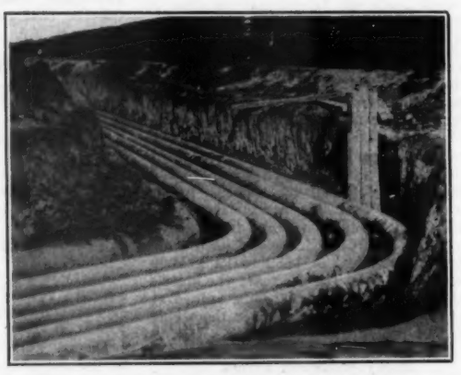
ARKANSAS FUEL OIL CO.

Gasoline gathering system near Willow Springs, Texas. All of the vacuum lines are AIRCOWELDED. Illustration shows a position AIRCOWELD in the making.



SHELL OIL CO. of Canada, Ltd.

At Montreal East Refinery gas and oil lines are AIRCOWELDED. Illustration shows one of the 90° bends in the lines. Two bends of 15° were made on the job with aid of welding torches.

SEATTLE GAS COMPANY

Relocated gas service lines serving North end of City of Seattle is AIRCOWELDED. Illustration shows a rolling AIRCOWELD in process.

Many developments have played a part in the wonderful growth and progress of the Oil Industry since the discovery of oil three-quarters of a century ago brought the Industry into being.

In the transportation end, not the least of these was the introduction of oxyacetylene welding of pipe lines. In pioneering and advancing his development lies AIRCO'S contribution. In AIRCO'S Research Laboratories this logical method of constructing pipe lines was brought to the point of maximum speed and economy by the perfection of the AIRCO-WELDING Process—*the process that cuts welding time in half and saves from 30 to 50% in rod and gases.*

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Definite evidence of the widespread use of AIRCOWELDING is presented by the representative oil, gasoline and natural gas lines and heating and power piping jobs illustrated and described in this bulletin. They show that AIRCOWELDING stands thoroughly tested and proved and its speed and economy firmly established. Write for your copy—today.

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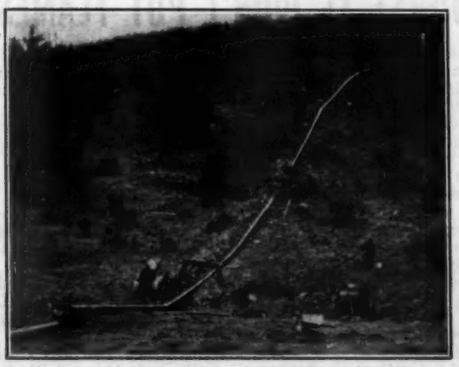
EXCELSIOR REFINING CO.
Gathering system and part of piping in plant are AIRCOWELDED. Illustration shows a test made by bending pipe around a tree. AIRCOWELDS held perfectly.



GAS COMPANY'S BRANCH LINE
to plant of Corning Glass Works, Corning, N. Y., is AIRCOWELDED. Illustration shows a trying condition in pipe line construction. AIRCOWELDS "took it" without a failure.

MISSOURI POWER and LIGHT CO.
Important section of line bringing natural gas to Excelsior Springs health resort is AIRCOWELDED. Illustration shows AIRCOWELDING in progress.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

OIL INDUSTRY

versary of its birth

The AIRCOWELDING Process is equally effective for the installation of piping in refineries, power plants and all other buildings.

The accompanying illustrations—typical scenes from AIRCOWELDED projects—give a faint idea of the extent to which the use of the process has grown. And with its soundness and economy fully established, AIRCOWELDING is well on its way toward becoming standard practice for the welding of pipe.

AIRCOWELDING, *with* AIRCO EQUIPMENT and SUPPLIES *backed by* AIRCO'S APPLIED ENGINEERING CO-OPERATION *and* NATION-WIDE WELDING SUPPLY SERVICE *assures the successful completion of any pipe welding project at rock bottom cost.*

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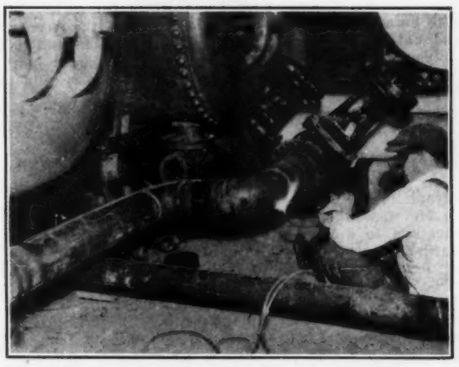
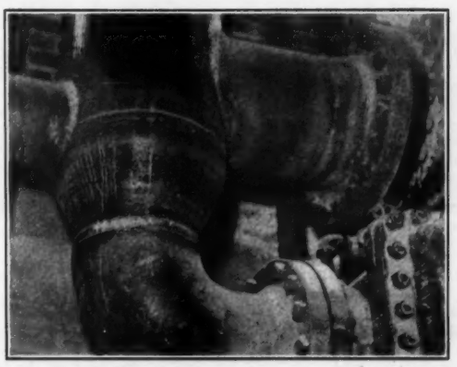
Without obligation AIRCO is prepared to demonstrate AIRCOWELDING to pipe line departments of oil and gas companies and piping contractors and to furnish complete details of AIRCO Equipment, Supplies, and Service. Your request, either to the home office or the nearest district office will bring a prompt response.

GREGG TEX GASOLINE CORP., Longview, Texas. *Natural gasoline gathering system is the third big project in the East Texas field to be AIRCOWELDED. Illustration shows a section of the firing line.*



NEW YORK STATE RECONSTRUCTION HOME. *Central heating system in this recently completed project is AIRCOWELDED thruout with AIRCO oxygen, acetylene, apparatus and supplies. Illustration shows AIRCOWELDING in progress.*



STATE HOSPITAL, Wingdale, N. Y. and STATE PRISON, Ossining, N. Y. *All heating and power piping in these new, modern power plants are AIRCOWELDED. Illustration shows a reducer at the prison job—a neat piece of welded piping.*

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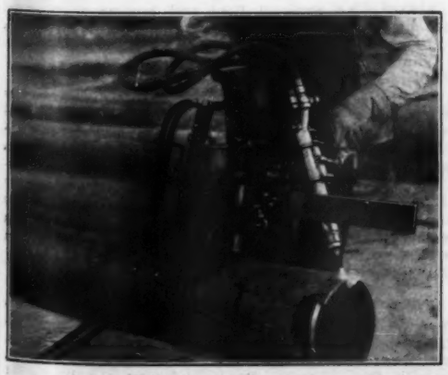

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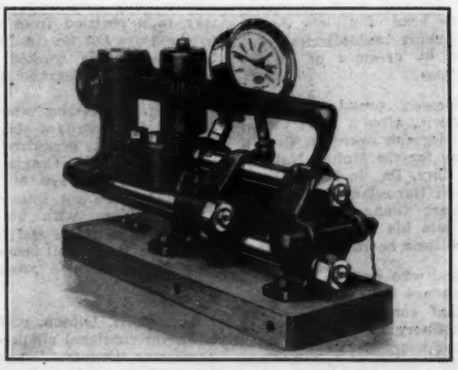

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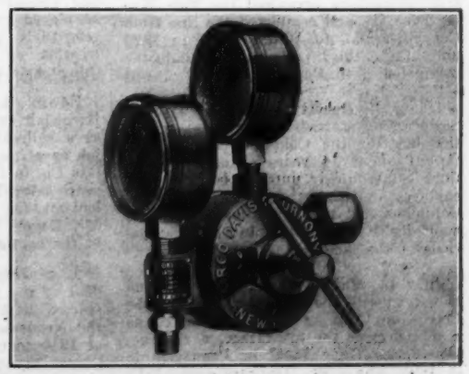

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CULLINAN . . HUNT . . CLARK . . BROOMFIELD . . SADLER . . REESER . . HOPKINS . . JACKSON . . HANRAHAN . . McLAUGHLIN . . HOENIG . . VEATCH . . WEBER

PERSONALITIES

Arthur F. Corwin, director of the Socony-Vacuum Oil Co., began his career in the machine shop of the South Penn Oil Co. in Mannington, W. Va., just after he had received a Ph.D. degree in 1899. He joined the Carter Oil Co. in 1901.

William G. Skelly, president of the Skelly Oil Co., started in 1894 as a clerk for the Oil Well Supply Co. at Oil City, Pa. He later did hard manual labor in a Cleveland lumber yard. When he came to Oklahoma from the Illinois Field, over 20 years ago, he told the late Uncle Dick Gray that he was out to make a million within the year and he came close to it in the southern Oklahoma Field.

Charles Page, who grew to be a multi-millionaire oil producer and natural gas man in Oklahoma, when a young fellow drilled a succession of dry holes and didn't get his real start upward until the early days of the fourth period, in 1907, in the north extension of the Glenn Pool.

John R. Manion, president of the Sinclair Prairie Pipe Line Co., began his pipe line career as a telegraph operator in 1891, at McDonald, Pa. He was promoted and transferred from one to another Standard pipe line until H. F. Sinclair induced him to cast his fortunes with his organization.

Edward G. Seubert, president of the Standard Oil Co. (Indiana), worked his way up from the humble job of mechanic's helper at the Whiting refinery, beginning in 1891. He was a good helper and a good mechanic and was good in all the successive jobs he was on and he finally reached the top.

Amos Ball, vice president in charge of marketing for the Standard Oil Co. (Indiana), fired boiler, filled tank wagons and did warehouse work in Marshalltown, Iowa, back in 1897, which was his first experience in the oil business.

Christy Payne, treasurer of the Standard Oil Co. (New Jersey), began his career as a bookkeeper for the National Transit Co., in Oil City, Pa.

The names of Byron D. Benson, David McKelvy, Alanson Ashford Sumner, S. Q. Brown, and Robert E. Hopkins are associated directly with the first pipe line to transport oil over the mountains with the Eastern Seaboard as the final objective. These men organized the Tide Water Pipe Co. and completed the line from Coryville, Pa., to Williamsport in 1879 and in the third period of the industry completed it to Bayonne, N. J.

Henry L. Doherty, head of the Cities Service Co., started his career as an office boy for the Columbus (Ohio) Gas Co. at about 14 years of age. Promotions came quickly until he became chief engineer and assistant manager with the Columbus and two other companies. He made his big reputation in the later periods of the industry.

John H. Markham, Jr., producer, and at the time of his death president of the Petroleum Corp. of America, started as a tool dresser for his father, a contractor in the Kane Field in Pennsylvania in 1893. The elder Markham dated back to the days when he loaded oil barrels for river shipment in the middle sixties.

E. E. Plumly, vice president and general superintendent of the Magnolia Petroleum Co., started as a day laborer in the Olean, N. Y., refinery of the Acme Oil Co. in 1896.

Sidney Keoughan, afterward president of the Continental Oil Co., is credited with having drilled the first producing well in Louisiana in 1901.

Capt. A. F. Lucas drilled the first oil well in the Spindletop Field near Beaumont, Tex. The captain had long looked at that hump called Spindle Top and decided it meant something more than just a rise in the ground, and he played his hunch.

E. R. Brown, chairman of the board of the Magnolia Petroleum Co., learned his first lessons in refining in that famous school for refiners, the Acme plant, in Olean, N. Y., in 1894-98, and then he went to Corsicana, Tex., and built the first refinery for the J. S. Cullinan Co.

J. S. Cullinan, for years president of the Texas Co., was a tank builder near Pittsburgh, Pa., in his early years. He went to Corsicana, Tex., in the late nineties and started the J. S. Cullinan Co., oil producer and refiner.

Seth B. Hunt, retired treasurer of the Standard Oil Co. (New Jersey), went out in search of a job in Providence, R. I., in 1894, and got one driving a Standard Oil Co. of New York tank wagon. He must have been a good driver and salesman, as the boss soon took him off that job and gave him a better one and his successive bosses kept doing the same thing until he became one of the directors in the big Jersey company.

Edgar M. Clark, who rose to be vice president of the Standard Oil Co. (New Jersey), went to work sweetening steam stills in the Wood River plant of the Standard Oil Co. (Indiana) in 1895. He did a satisfactory job of it and rose steadily to a position of eminence and great usefulness.

R. A. Broomfield, executive vice president of the Barnsdall Oil Corp., started his oil career in the early days of the third period in the employ of the J. M. Guffey Petroleum Co.

E. J. Sadler, vice president of the Standard Oil Co. (New Jersey), when he was hauling pipe with a team of mules through the dust or the mud of the Kansas oil fields back in 1900, may not have had visions of the day when he would be placed at the head of all the Jersey company's producing subsidiaries, but whether or not he dreamed of it, the thing came to pass.

Edwin B. Reeser, president of the Barnsdall Oil Corp., after a short period as a railroad telegraph operator, took a job as office boy for the United Natural Gas Co. in Oil City, Pa., in 1891. A few years later T. N. Barnsdall, ever on the lookout for smart young men, induced Mr. Reeser to join his organization and in the course of time he rose to the top.

A. S. Hopkins, who rose to be president of the Standard Oil Co. of Kansas, started with that company in 1897 in the Neodesha refinery as a day laborer at 12½ cents per hour.

Allan Jackson, vice president of the Standard Oil Co. (Indiana), started with the company in 1896 as secretary to one of the officials.

Ralph V. Hanrahan, president of the Humble Pipe Line Co., having been born in Cattaraugus County, New York, the cradle of so many pipe line men, naturally sought a pipe line job as a lad, and landed with the Indiana Pipe Line Co. in 1901, and his climb from the bottom to the top was steady.

M. J. McLaughlin, vice president and manager of production for the Magnolia Petroleum Co., gained his first oil experience as a roustabout in the Clarion County fields in Pennsylvania in 1899.

A. V. Hoenig, vice president and production manager for the Indian Territory Illuminating Oil Co., started with the old Carter Oil Co. as a telegraph operator in the Eastern fields in 1896.

A. C. Veatch, internationally known geologist and mining engineer, turned his attention from mining to oil shortly after the Lucas gusher was struck on Spindle Top near Beaumont, Tex.

Norton Homan Weber, vice president of the Pure Oil Co., when a boy in Titusville, Pa., was so anxious to go to work that when the agent of the W.N.Y.&P. Railroad wouldn't give him a salaried job he offered to start for nothing and he was put to work on that basis, but the agent soon placed him on the payroll, and in three years he was chief clerk and cashier. Mr. Weber joined the Pure Oil Co. in 1889 as a bookkeeper in the Oil City offices.

William H. Isom, vice president of the Sinclair Refining Co., whose introduction to the oil business in a big way came in the third period of the industry when he was made president and general manager of the Standard Oil Co. of Minnesota, a marketing organization, started in the second period in Toledo as an oil jobber in 1879 and built and ran the first refinery west of Cleveland in 1881, in Toledo.

E. Rogers Kemp, who rose to be president of the Sinclair Oil & Gas Co. began his business career as a clerk in the offices of Richard Jennings & Sons, producers, in Pittsburgh, in 1889. He was head of the Toxaway Oil Co. in 1916 when his company sold to the Sinclair organization, which Mr. Kemp immediately joined.

Robert Wallace McIlvain, vice president of the Pure Oil Co., started at the bottom as a roustabout and worked his way to a position from which he went to the Pure Oil Co. in 1914. Before going into oil he worked at mining in North Dakota, Montana and Colorado.

Edgar L. Marston, who became chairman of the board of the Texas Pacific Coal & Oil Co., organized his first business venture, the Cragin Cattle Co. in Missouri at the age of 23, and made good. Then he got into coal mining at Thurber, Tex., with his father-in-law, Col. R. D. Hunter, and they made millions. The Ranger oil boom in later years gave Mr. Marston a prominent place in oil.

Addison H. Gibson, of Gibson & Zahniser, international oil producers, was an Armstrong County, Pennsylvania, product, who began his oil career with Pew & Emerson, oil and gas operators, in Pittsburgh. He started out for himself at an early age and was successful. In 1911 the firm of Gibson, Zahniser & Vincent entered the Mexican fields. In 1916 its first well in the Tepetate fields in Vera Cruz, started at 50,000 bbls. per day.

George Percy Whaley, who rose to be president of the Vacuum Oil Co., started as a clerk with the old Standard Oil Co. of Pennsylvania, later the Atlantic Refining Co. In three years he was made manager of the sales division at the age of 23.

Clint (Pop) Moore, prominent operator and pioneer in the Eastern and Mid-Continent fields, started in the oil business in Pithole as soon as he was mustered out of the Federal army in Rochester, N. Y., in 1865. Young Clint, less than 17 years of age, walked from Rochester to Pithole, a distance of 200 miles, to land his first job.

Capt. N. V. V. Franchot, of Olean, N. Y., Eastern and Mid-Continent operator and a pioneer in both fields, one of the oldest active oil men in the world, has more tools running in 1934, and at 79 years of age, than he ever had before, indicating that he is still looking into the future and not bothering about the "good old days."

R. R. Hobson, general manager of the Houston Oil Co., was a roughneck for the Higgins Gas & Fuel Co. in 1901 in the Spindletop Field.

George H. Jones, who, at his death, was chairman of the board of the Standard Oil Co. (New Jersey), learned stenography and typewriting as a boy and went to work in the Oil City offices of the National Transit Co., as secretary to W. W. Splane.

C. G. Hamill, Gulf Coast independent operator, is a pioneer Texas oil man, having started in 1897 in the Corsicana Field as a drilling contractor.

W. Scott Heywood, president of the Jennings-Heywood Syndicate, was a producer in the Coalinga Field in California in 1896, but was among the early arrivals in the Gulf Coastal Field, after the Lucas gusher was completed in 1901.

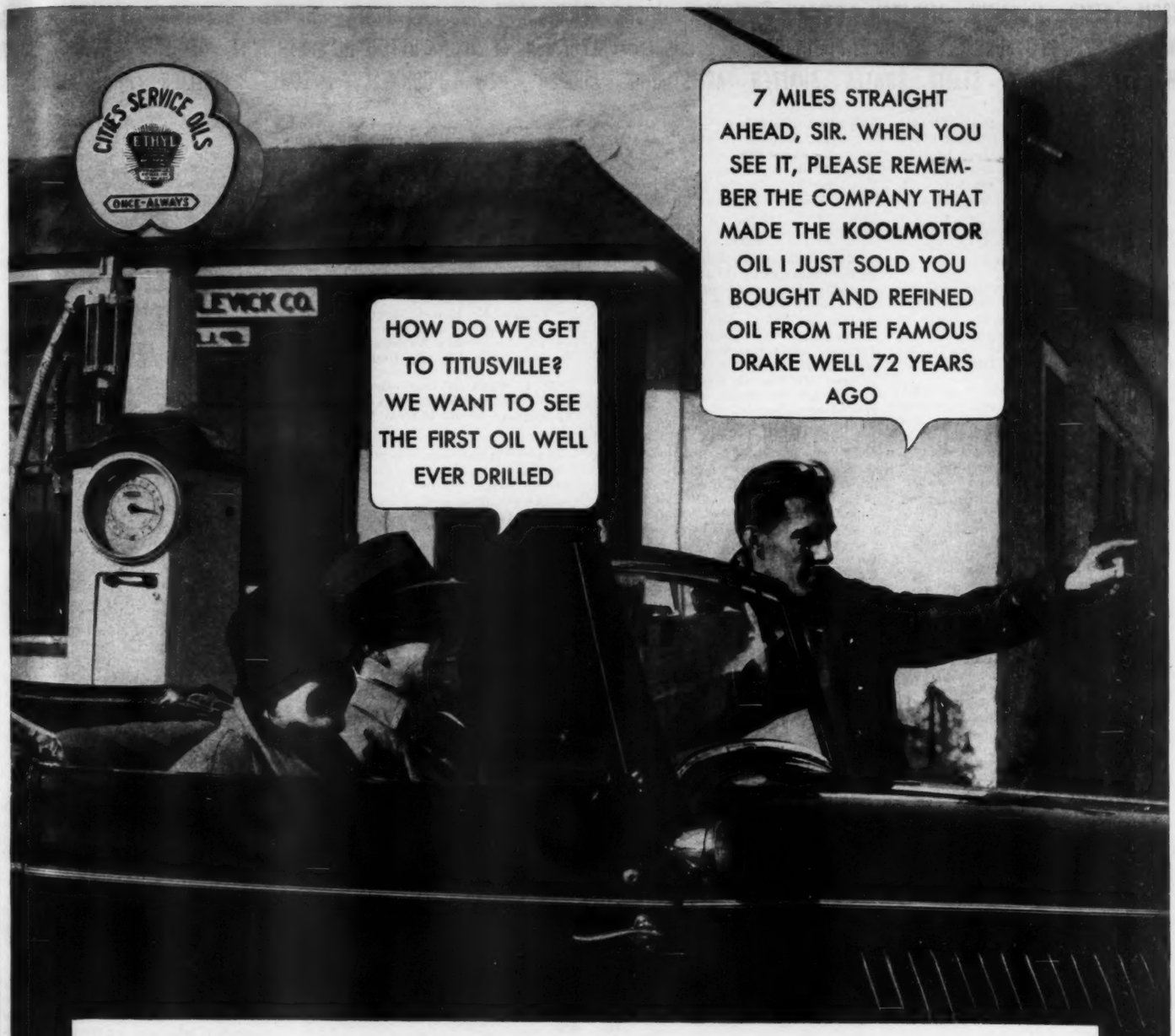
R. L. Blaffer, president of the Humble Oil & Refining Co., dates back to Spindletop in 1902, when he became associated with William S. Farish.

Silas W. Canaga, who with a group of other Scio, Ohio, citizens opened the Scio oil field and became a successful producer, was a clerk in a dry goods store in Scio for 15 years and then became a partner in the business.

One of the interesting figures of the northern oil fields in the seventies and early eighties was Julius F. Ross, who built the Bradford Oil Exchange and was in charge of the construction of the narrow gauge railroads that traversed every part of the Bradford and Allegany Fields. At one time one could travel from Wellsville, N. Y., to Foxburg, Pa., on railroads with a 3-foot gauge. Later Mr. Ross went with Buckeye Pipe Line Co.

Thomas White, who in later years headed the White Oil Corp. began his career as a dealer in oil field supplies. In after years his activities, with his brother P. J., and with the White Oil Corp., helped develop fields in Pennsylvania, Kentucky, Ohio and the Mid-Continent.

Patrick Justin White, later of White & Sinclair, first started to work for the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HOW DO WE GET TO TITUSVILLE? WE WANT TO SEE THE FIRST OIL WELL EVER DRILLED
7 MILES STRAIGHT AHEAD, SIR. WHEN YOU SEE IT, PLEASE REMEMBER THE COMPANY THAT MADE THE KOOLMOTOR OIL I JUST SOLD YOU BOUGHT AND REFINED OIL FROM THE FAMOUS DRAKE WELL 72 YEARS AGO

IN 1862 . . . just three years after the discovery of the historical Drake Well . . . a company, now a Cities Service marketing company, began to refine and perfect petroleum products. The crude came from the Drake Well.

In fact, today, KOOLMOTOR . . . the *perfect* Pennsylvania motor oil . . . is made in the famous Cities Service refinery in Titusville . . . almost in the very shadow of the original Drake Well. Refined from only the choicest crudes produced in Pennsylvania, KOOLMOTOR Oil seals, lubricates and cools engines perfectly. It is available in refinery-sealed cans and marketed by 15,000 stations and dealers throughout the country. Investigate the profit possibilities for you in this great oil. Write, wire or telephone your nearest Cities Service subsidiary for more details.

For full information about the resale value and profit possibilities for you in this time-tested, proved quality product write to the nearest Cities Service subsidiary listed below:

Cities Service Oil Co. (DELAWARE), Tulsa, Okla.
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Cities Service Oil Co. (WIS.), Milwaukee, Wis.
Cities Service Oil Co., Ltd. . Toronto, Canada
Cities Service Refining Co. . . Boston, Mass.
Crew Levick Company . . . Philadelphia, Pa.
Empire Oil & Refining Co. . . . Tulsa, Okla.
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WHITE . . STEWART . . HASSETT . . HURLEY . . WRIGHTSMAN . . COSDEN . . BLACKMER . . FARISH . . DETERDING . . STRAIGHT . . SINCLAIR . . DORN . . ORCUTT
WILLIAMS . . HOLMES . . STAITI . . BOWLES . . SHAFFER . . ARMSTRONG . . COOPER . . PEW . . O'DONNELL . . MALONEY . . PHILLIPS . . PRATT . . BARSTOW

Pickett Co., a subsidiary of the Oil Well Supply Co. in the Pennsylvania oil field in 1889. He was made store manager and then was called in for more advanced service with the parent company. He joined his brother, Thomas White, to make up the White Bros. who operated successfully in Kentucky. P. J. White and H. F. Sinclair later made history in the Cushing Field in Oklahoma.

Robert W. Stewart, for years president of the Standard Oil Co. of Indiana, came into the oil business from the law. He gained a notable reputation as a lawyer when he was made general attorney for the Indiana company in 1907.

W. B. Hassett, who headed the Ohio Cities refining department before he went out for himself and headed a number of refineries in the Mid-Continent Field, learned the machinist trade in Warren, Pa., at the latter end of this period, and for time played professional baseball. He had other ambitions than to become a second Amos Rusie, and he went into the refining business as a mechanic and worked up to the high brackets.

Patrick J. Hurley, who became vice president and director of the Gilliland Oil Co. and later Secretary of War in the cabinet of President Hoover, was a trapper boy in a coal mine in Indian Territory at the age of 9, later became a clerk in a general store, a cowboy, a college graduate, oil man, soldier and statesman.

Charles J. Wrightsman, successful producer, president of the Wrightsman Oil Co., was a lawyer and politician before going into oil as an operator and producer in Oklahoma in 1904.

Joshua S. Cosden, who organized and for years headed Cosden & Co. refiner, and Cosden Oil & Gas Co., producer, in the Mid-Continent Field began his business life as a salesman in Maryland. He came out to Oklahoma and started a little refinery at Bigheart, Osage County, and built up a big business.

Henry M. Blackmer, who for years headed the Midwest Refining Co., was a successful lawyer and organizer when he was made vice president of the Midwest company in 1914. He was a New Englander, but went to Denver, Colo. in 1891 to practice law.

William S. Farish, chairman of the board of the Standard Oil Co., (N. J.) and one of the founders of the Humble Oil Co., intended to be a lawyer and graduated in law, but the oil fever got him and he became a drilling contractor in the early days of the Gulf Coast Field and later a producer. His first work in the oil business was with the Texas Oil Fields, Ltd., an English concern. The Humble Oil & Refining Co. grew out of the Humble Oil Co., and became a subsidiary of the Standard Oil Co. (New Jersey).

Sir Henri W. A. Deterding, general managing director of the Royal Dutch-Shell Combine, started to work in a bank in Holland as a bookkeeper. He was sent to Java to straighten out the tangled accounts of the Royal Dutch Co. in that field. He was only a very young fellow at the time, and when he looked the situation over upon his arrival it appeared a hopeless job but he tackled it and made good. From that on his progress was continuous, finally placing him among the world's leading oil men.

Herbert R. Straight, vice president and general manager of the Empire Oil & Refining Co. learned the rudiments of the oil business on his father's leases in the Bradford Field in Pennsylvania. While attending prep school and college his vacations were spent largely in learning how to produce oil and he took part in everything from drilling to cleaning out. He joined the Doherty organization about 1916 and organized and conducted the company's gigantic drilling campaign in the Augusta-El Dorado Fields in Kansas, which began soon after he took charge.

H. F. Sinclair, chairman of the board of the Consolidated Oil Corp., was a registered pharmacist in Independence, Kan., when he decided there was more money in the oil business. Mr. Sinclair's success in the business began early because, while the average fellow was making up his mind as to the merits of a lease, Mr. Sinclair was on his way on an all-night buckboard trip to the farmer's house to buy it.

Forest Dorn, president of Forest Oil Corp., one of the largest operating companies in the Pennsylvania grade fields, started his business career at 17 years of age by getting an option on a small parcel of standing timber, also on a portable sawmill, and finding a buyer for the finished lumber, and then without batting an eyelid confronting Bradford's biggest banker and coolly asking a loan of enough to swing the deal. He got the money. Before he had reached legal age young Dorn had swung deals big enough to staggee the average business man, and they were all successful.

W. W. Orcutt organized the first geological department in the California fields for the Union Oil Co. and is still in charge of it.

H. L. Williams, drilled the first well in Summerland, California, Field, but failed to get commercial production. It was drilled to 455 feet.

Ralph C. Holmes, soon after leaving high school, obtained a job in the Acme Refinery in Olean, N. Y., and later left for an advanced position with the Standard Oil Co. of New York.

H. T. Staiti, prominent Gulf Coast operator, made a personal survey of Spindletop and the Sour Lake and Saratoga areas for oil purposes back in 1898, years before the Spindletop Field was discovered.

William V. Bowles, prominent Gulf Coast drilling contractor, first fired boilers for the German American Oil Co. in the Spindletop Field in 1901.

D. C. Shaffer's first connection with the natural gas business was in 1897 as an employe of the Buffalo Natural Gas Co.

Andrew Armstrong, who rose to a high place with the Union Natural Gas Corp. in Pittsburgh, started his career as a bookkeeper in a meat market. He was rescued by E. P. Whitcomb, who took him into the old Barnsdall organization. Incidentally Armstrong side-stepped opportunities to go into big league baseball in the late eighties. He was a hard-hitting infielder with a Hans Wagner throwing arm.

H. C. Cooper, vice president and general manager of the Hope Natural Gas Co., began in the National Transit Co. shops in 1891.

John G. Pew, who became head of the People's Gas Co. of Pittsburgh, started with that company in 1886 as a pipefitter's helper.

Thomas A. O'Donnell, who rose to be chairman of the board of the California Petroleum Corp., and first president of the American Petroleum Institute, was a newsboy in Bradford, Pa., in 1878, and as soon as he was big enough he got a field job with a Bradford oil company. His rise to the top was steady.

Martin Maloney, noted capitalist, who became interested in oil in the seventies with H. H. Rogers and Charles Pratt & Sons in a plan to develop street lighting with naphtha burners, learned the tinsmithing, plumbing and gas fitting trades in Scranton when a young man.

Thomas W. Phillips, who with his three brothers, I. N., J. T., and C. M. Phillips organized the Phillips Brothers in 1863, a firm out of which grew an organization that is still prominent in Pennsylvania oil business, properly belongs to the first period, as he started in the business in 1861. The Phillips Brothers were the first to go out and lease land in large blocks for exploration purposes and they amazed their fellow operators who seemed content in many cases to lease tracts big enough to accommodate the derrick and drilling equipment for one well.

Herbert Lee Pratt, chairman of the board of Socony-Vacuum Oil Co., was born into the oil business as he is a son of the late Charles Pratt. He started his career in the third period as a clerk in the Bergen Point Chemical Works. His next job was assistant to the manager of the Standard Oil Co.'s Pratt Works and the Queen's County Works in Brooklyn, N. Y.

Frank Q. Barstow, is another who properly belongs to the first 15-year period of the oil business as Barstow, Darrow & Co.'s refinery was established in Cleveland in the sixties. It was sold to the Standard Oil Co. of Ohio in 1873 and Mr. Barstow joined the Standard, his first work being to buy barrel staves. He rose to be a director of the Standard.

Nelson K. Moody, president of the Sinclair Prairie Oil Marketing Co., began as a roustabout for the old Carter Oil Co. in West Virginia in 1899. George Moody, vice president of the Mid-Continent Petroleum Corp., in charge of production, followed Nelson K. on the same roustabout job three years later when Nelse, the elder brother, began to move up. Another successful young Carter roustabout who went up the ladder to high places was R. F. MacArthur, who became manager of the Barnsdall Oil Co. Colonel Carter gave Bob a job in 1897. John Eckbert, Colonel Carter's manager, put him to work with a shovel unloading a car of soft coal.

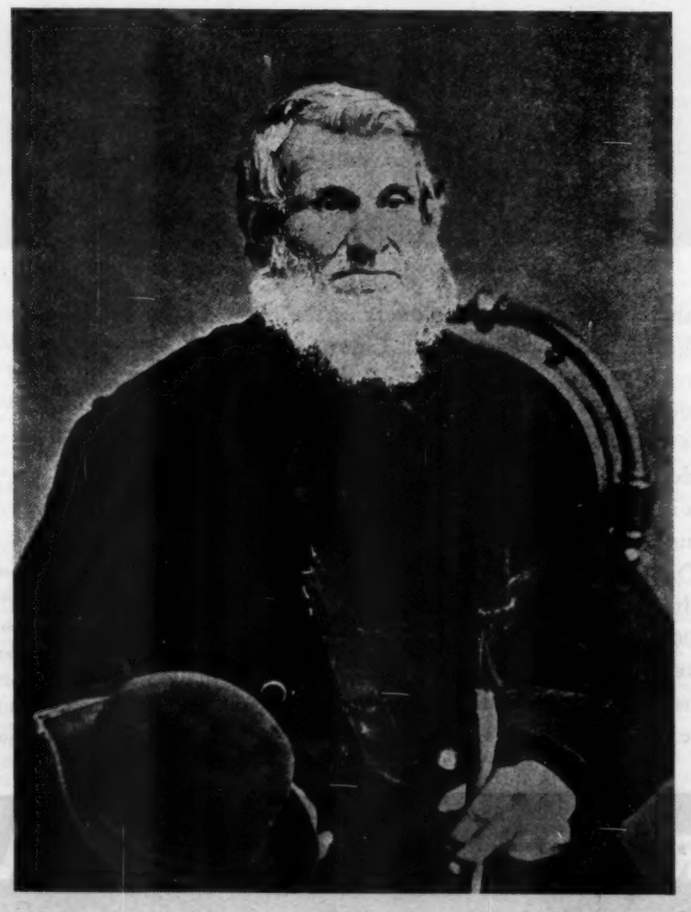
Clark Kountz, chairman of the board of the Sinclair Prairie Pipe Line Co., started as a messenger boy in the telegraph department of the Ohio Oil Co. in Findlay, Ohio, in 1901.

W. F. Gates, president of the Prairie Pipe Line Co. for many years, began with the West Virginia Transportation Co. in May, 1884. The company owned a pipe line and a railroad and Bill Gates was gauger for the pipe line, conductor on the railroad and oil inspector, all rolled into one job.

Underwood Nazro, vice president of the Gulf Production Co., went to work in the office of the Henry Oil Co. in Chicago in 1896, but was soon sent to West Virginia, where he was a clerk in the warehouse and office of the Henry company.

Frank W. Kirk, general manager of the Houston Pipe Line Co., worked on the pipe line gang that laid the Pan American line between Chicago and the Indiana Field about 1886.

C. H. Chambers, president of the Minor Oil Co. (Texas), became a tank contractor in 1901, later becoming a producer.



William A. (Uncle Billy) Smith, driller of the Drake well

DEVELOPMENT OF AUTOMOBILE AND SUCCESSFUL FLIGHT OF AIRPLANE FEATURED ERA 1889-1904

MARKETING—ERA NUMBER 3 1889-1904

Pioneering in the automobile and aviation fields featured the third period, 1889-1904, in the marketing history of the petroleum industry. While it was in 1879 that George B. Selden, of Rochester, N. Y., filed with the patent office in Washington an application for a patent on a road locomotive powered by a gasoline engine, it was not until 1895, after various American and European manufacturers had developed Selden's idea, apparently without ever having heard of Selden, that the patent was issued and infringement suits were started. Many of the manufacturers conceded the validity of the patent, and formed an association of licensed automobile manufacturers.

Automobile production figures are available from 1895 forward. Four cars were made in 1895; 25 cars in 1896; 100 cars in 1897; 1,000 cars in 1898; 2,500 cars in 1899, and 5,000 automobiles in 1900. The output figure increased by 2,000 each year until 1904 when the production was doubled.

In 1891 Charles E. Duryea began the first American internal combustion automobile engine, and in 1894 he had built five of the "horseless carriages." The engine was of the four-cycle type, and the car was equipped with electric ignition,

Automobile designed by Elwood Haynes

rigid front axle, present type of steering gear and pneumatic tires, in 1894. Duryea's first horseless buggy was completed in 1893.

Early Cars

Because the fuel was mixed with air by passing air over a series of shallow trays filled with gasoline, there was considerable trouble due to the heavier fractions of the motor fuel accumulating on the trays. The fuel desired was as nearly a homogeneous 0.68 specific gravity material as could be produced. Obviously, the petroleum refiner had considerable difficulty supplying this requirement. In 1893 appeared the device which solved the problem for the refiner. This was Maybach's carburetor, which made possible the use of a wide range of volatile fuels. In 1894 Elwood Haynes drove to Kokomo, Ind., without having to rebuild the car of his own invention. In 1895, de Dion Bouton fitted his engines with high tension ignition systems having non-trembling coil and dry battery and with air cooled, finned cylinder, aluminum crankcase, splash lubrication, automatic inlet valve, and running at 1,500 to 1,800 r.p.m. Water-cooled engines did not gain prominence until 1902.

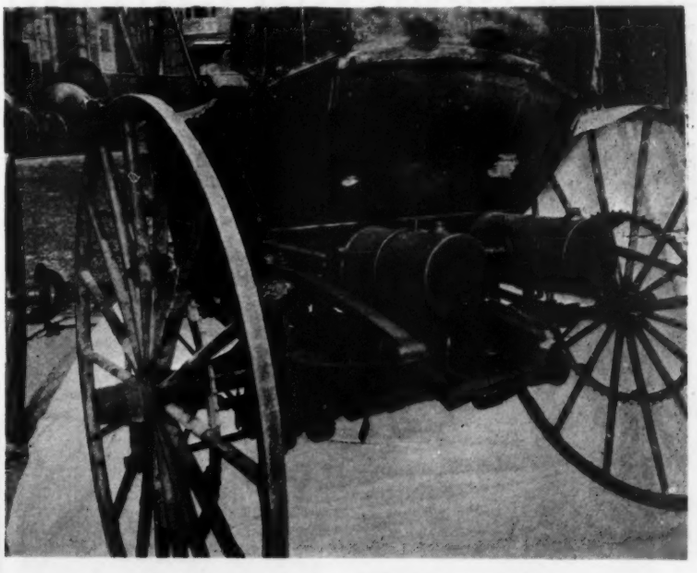
In 1902 Prof. William Robinson divided petroleum engines into four broad classes, according to the methods of vaporizing and treatment of the petroleum in preparing the charge for combustion. The Diesel engine, invented in Germany in 1895, was not discussed, nor was the automobile engine. His "types" will be discussed in another place in this article.

Air Flights

The first successful flight in a heavier than air machine was made on December 17, 1903, by Orville Wright at Kill Devil Hill, near Kitty Hawk, N. C. The airplane was designed by Orville and Wilbur Wright. This flight lasted only 12 seconds. Wilbur then made a flight of slightly less than 13 seconds, and Orville in a second flight that day stayed up 59 seconds, landing his machine at a point as high as the starting place. On November 9, 1904, Wilbur Wright took off at Dayton, Ohio, remaining in the air 4 minutes and 30 seconds and covering a distance of 3 miles. In that year he made 105 flights.

While the Wright brothers' airplane was powered by a gasoline engine, motive power had been applied much earlier to flying machines in which no passengers were carried. Compressed air propelled the airplane sent on a 100-foot flight in 1878 by Tatin, and that of Hargrave in 1885 which covered a distance of 343 feet. Five airplanes employing steam power followed thus: In 1893, by Phillips; in 1894, by Maxim; in 1896, by Langley; in 1897, by Tatin and Ritchet. The gravity or glider types of airplanes were introduced in 1895 by Lilienthal, in 1896 by Pilcher, and in the same year by Chanute. Wilbur and Orville Wright in 1900, at Dayton, began to experiment with gliders and in that year introduced ailerons and rudders.

In the succeeding period, 1904-1919, the automobile and the airplane made tremendous advances, and the Zeppelin made its appearance.



Fuel tanks and view of Duryea automobile

New Products

An interesting development of 1894 was the process patented by Weygang in England for production of a petroleum product miscible with or soluble in water. A resin previously dissolved in petroleum was partly saponified, only about one-half of the resin acid present being combined with the alkali employed, and the resin soap thus formed being rendered soluble in the petroleum by the presence of the unsaponified resin. From this primary product the inventor produced a siccative oil by treatment with a dryer; a turpentine substitute; a soluble solid oil, suitable for use in soap making; a soluble semisolid oil for use as an insecticide, sheep wash, or in dressing wool and fibers generally; lubricating oils and creams; medicinal and toilet preparations; printing inks.

Fuel Oil

The use of fuel oil in place of coal in locomotives and vessels gained ground in the latter part of this era. In 1904 the U. S. Liquid Fuel Board issued an exhaustive report on the relative evaporative efficiencies of coal and fuel oil under forced and natural draught. Topped Texas crude from which the sulphur had been removed was used in the tests and its B.t.u. was 19,481 as compared with 14,067-14,992 of the Pocahontas and New River coal used. The tests were made on locomotives and torpedo boats and the advantages of the use of oil in place of coal were listed as follows: Economy of space; ease of bunkering; rapidity of time in meeting a varying load on boiler; ability to force boiler to extreme duty in case of emergency; absence of smoke under light normal working conditions; short height of stack; superior personnel available for operation of the burners, and ability to secure and maintain higher speed than with coal.

In the Robinson report of 1902, mentioned above, the "four" broad types of petroleum engines in this period were described as follows: (1) The measured charge of oil is sprayed by compressed air into a vaporizer, heated by exhaust gases and the vapor carried by the charge of air past the admission-valve into the motor cylinder, where the mixture is further heated by the residual products and cylinder walls, compressed and fired. (2) The oil is injected by a pump as fine jets of spray into the residual products of combustion and air contained in a red hot cartridge or vaporizer always open by a narrow neck to the end of the motor cylinder. The vapor is mixed with excess of air which is admitted to the cylinder by a separate valve and the air is compressed by the motor piston into the red hot vaporizer and clearance space forming the combustion chamber where the mixture is fired by compression against the heated surface. (3) (a) A small vaporizer is kept red hot by the flame from a lamp which also heats the ignition tube, and the measured charge of oil is delivered by a pump and sucked through the vaporizer with a little hot air to carry the oil vapor through a separate valve into the cylinder, where it is mixed with the residual products, and the main supply of cold air drawn through another valve. (b) The oil is allowed to drop on a heated surface and is swept along with the larger part of the charge of air previously heated, and then drawn through a vaporizer and admitted by a valve into the motor cylinder where it is mixed with the burnt products and little or no additional air. (4) Each charge of oil is drawn in with the whole charge of cold air by the valve through the vaporizer into the combustion chamber. The combustible mixture is compressed and ignited as in 3. Sir Boverton Redwood, discussing Professor Robinson's paper, adds the Diesel engine to this list pointing out that in this engine the liquid oil is injected through a spraying nozzle in finely divided particles into a large excess of air, highly heated by compression in the motor cylinder, where ignition takes place spontaneously.

In the Mid-Continent, Prairie Oil & Gas Co., on November 10, 1904, changed its method of grading oil bought, so that instead of grading all oil from a certain district at a given price, each tank was graded according to its specific gravity.

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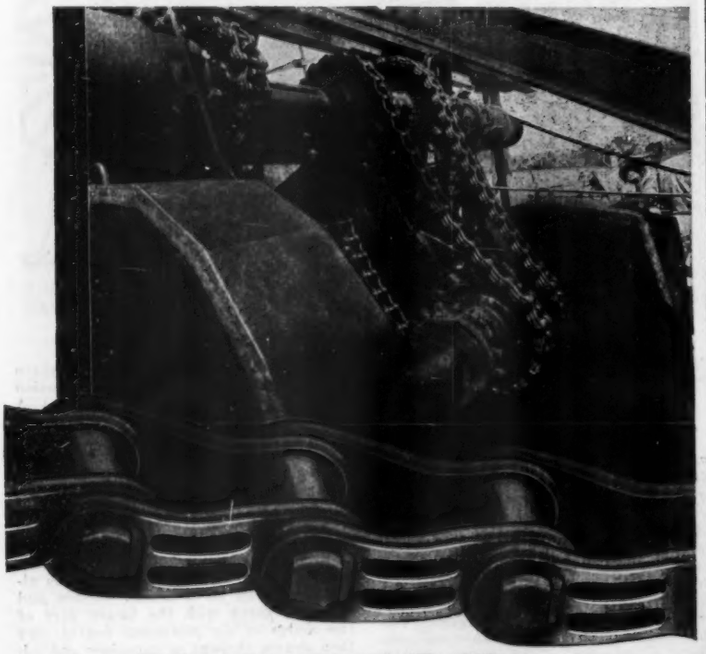

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HYPER CHAINS - RED-HED CHAINS - SILVERLINK ROLLER CHAINS

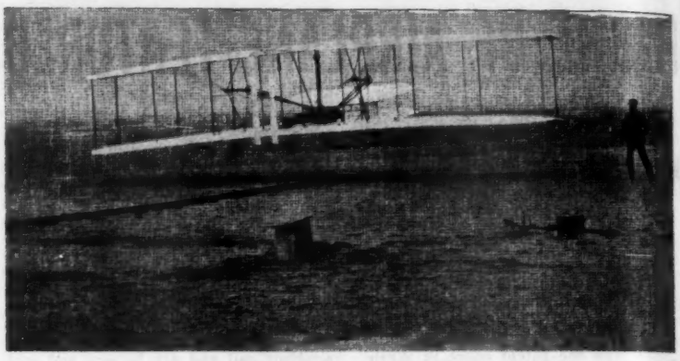
All of the oil above 32° Be. received a certain price, and for each half degree below this a reduction of 5 cents was made down to 28° Be., and oil from 28° to 22° Be. received a price 1 cent less than the 28 degree oil.

Speculation in oil and trade on the exchanges declined steadily throughout the early part of this period. On January 22, 1895, Joseph Seep changed his method of buying credit balances, quoting on the basis of world markets.

Refined Prices

Average yearly prices of refined oil per gallon, in barrels in New York, were as follows: 1890, 7⅝ cents; 1891, 6.93 cents; 1892, 6.07 cents; 1893, 5.24 cents; 1894, 5.19 cents; 1895, 7.36 cents; 1896, 6.98 cents; 1897, 5.91 cents; 1898, 6.32 cents; 1899, 7.98 cents. Prices of refined oil in cases and barrels in New York: 1901, 6.90 to 7.95 cents a gallon in barrels; 7.9 to 9 cents in cases; 1902, 7.2 to 7.9 cents, in barrels; 8.3 to 9.2 cents, in cases; 1903, 8.2 to 9.5 cents, in barrels; 10.5 to 12.2 cents, in cases; 1904, 7.7 to 9.1 cents, in barrels; 10.4 to 11.8 cents in cases.

Acquirement of the foreign markets and solidification of the position of the United States as the principal petroleum exporting nation, came only after bitter contests with foreign competitors and the solution of difficult problems involving trade barriers, heavy taxes, antiquated methods of distribution, strange local regulations and customs, and national prejudice. The Standard Oil Co. in 1885 inaugurated its foreign merchandising service after a study covering five years. This involved incorporation of many new companies abroad and alliances with older establishments, the building of foreign refineries, large and small storage and warehouse terminals and plants. Ten years later the company had 70 large importing stations abroad, 4,000 interior stations, 16 manufacturing plants, 2,000 tank cars, 4,000 tank wagons, 150 coasting vessels and barges.



Orville Wright making flight at Kitty Hawk, N. C., in 1903 with Wilbur Wright running alongside the plane

Interesting Developments

Interesting developments in the period 1890-1904 include the following: In 1900 John P. Holland, United States, invented a submarine employing gasoline engines for motive power on the surface of the water, and electrical installations for movement under water. Max Laubeuf built a submarine similarly powered in the same year. Other happenings of 1900 were the inclusion of benzinum purificatum in the U. S. Pharmacopoeia; the devising of a burner and hot air furnace using "88 gasoline" by Raymond Greenwood, of Atlantic Refining Co. The production of "briquettes" for fuel uses, employing crude oil, tars, coke, sawdust, etc., by a number of workers in various countries. In 1893, F. A. Rossmassler described a process for manufacturing "perfumery" and mixing oils. These had specific gravities of .88 to .885 and were colorless, odorless, without fluorescence, and stable to sunlight. These were on the order of technical white oils. In the same year James Atkinson patented a blue flame wick burner, and other manufacturers devised means of utilizing the Welsbach mantle with kerosene lamps. In 1899, Elmore invented oil flotation of ore.

EXPORTS, 1890-1904 (in gallons)

Year—	Crude	Light naphtha	Kerosene	Lubs	Residue
1890	96,572,625	12,462,636	550,873,438	32,090,537	1,830,612
1891	96,722,807	11,424,993	531,445,099	33,310,264	1,402,414
1892	104,397,107	16,393,284	589,418,185	34,026,855	403,933
1893	111,703,503	17,304,005	642,239,816	32,432,857	541,044
1894	121,926,349	15,556,754	736,363,626	40,190,677	211,688
1895	111,285,264	14,801,224	714,859,144	43,413,942	127,560
1896	110,923,620	12,349,319	716,455,565	50,525,530	204,940
1897	121,488,726	13,430,320	795,919,525	51,228,284	12,230,902
1898	114,915,082	17,026,626	761,152,107	63,968,341	29,413,454
1899	117,683,967	17,904,015	724,562,992	69,329,188	21,544,270
1900	138,161,179	18,570,488	739,163,464	71,211,353	19,749,996
1901	127,006,002	21,684,754	827,479,493	75,306,338	27,596,351
1902	145,233,723	19,682,637	773,800,973	83,200,503	38,315,700
1903	126,511,687	12,973,153	691,827,234	95,621,941	9,752,240
1904	111,176,476	24,989,432	761,358,155	89,688,133	34,904,190

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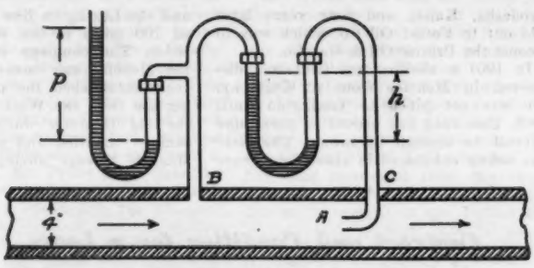


First Pitot tube used in measuring flowing gas in a pipe line. "A" ⅝-inch pipe; "B" to "C" 12 inches; "p" static pressure observed here; and "h" velocity pressure observed here

STEPS TAKEN IN THIRD ERA TO ELIMINATE GAS WASTE

NATURAL GAS—ERA NUMBER 3 1889-1904

In the period 1889-1904, with the known gas pools nearly exhausted, the industry turned over a new leaf in the face of bitter opposition from the consumers. It was a period of injunctions, riots against the introduction of meters, of reversions to use of coal among manufacturers, and of steadily increasing revenue from decreasing output. In the latter half of the period the industry was greatly encouraged by the finding of new gas sands in the old areas, particularly in West Virginia and Pennsylvania. Productive horizons were uncovered in Ohio and Indiana, but these were quickly depleted. This was a period of invention and resourcefulness on the part of the gas companies and equipment manufacturers, and in the period that followed, 1904-1919, the discoveries of vast gas areas in the South and West found the industry prepared to eliminate undue waste and to utilize the new sources to a much greater extent. Gas compressors, high pressure transmission mains and distribution systems, orifice and proportional meters, and educational programs born in the 1889-1904 period have made the natural gas industry what it is today.

The dwindling supply of gas after 1889 was felt more acutely as the third period progressed. On April 30, 1890, the first increase in gas rates was made. This was in Pittsburgh, where the price was advanced 50 per cent. The gas companies in Indiana were less fortunate. With their fields nearly exhausted, the companies tried unsuccessfully to have laws passed in 1897, 1899 and 1901, providing for compulsory measured service for natural gas. The proposed law was attacked by the newspapers and public meetings were held all over Indiana to denounce the gas companies. The Philadelphia Co. sought to install the meters in 1889, but it was not until 1896 that all of the gas sold by the company was metered and paid for on the basis of the amount actually used. It is interesting to note that while the Indiana legislature was refusing the permit of profitable operations in natural gas, the State brought a test suit against the Ohio Oil Co., asking for an injunction to prevent waste of natural gas incident to the drilling of oil wells in the Indiana fields.

Meters for Natural Gas

In 1900, when the pressed steel and cast iron meters were introduced to the gas companies but not to the consumers, the gas companies began to advertise that preparations should be made to provide for use of some standby fuel. In this year failure of the natural gas companies was freely predicted, and the steel mills of the Pittsburgh region were returning to the use of coal because of the uncertainty of the natural gas supply. Manufactured gas was sold on a metered basis, each customer having a "tin box." This meter was the one produced in 1884 by Richards and Croll, with some improvements. The leather diaphragm type was adopted by the natural gas industry after the tin box was replaced with cast iron or pressed steel in 1900. The so-called high capacity type of diaphragm meter was introduced in 1904. The Pitot tube was also advocated in 1901 for measuring natural gas consumed. All gas sold was on a basis of candle power and it was not until 1908, in Wisconsin, that the heat content of the gas was used as the basis.

It may not be amiss to discuss the metering instruments and formulae of the third period in the history of natural gas before proceeding to the other developments of discovery and utility. Measurement of natural gas was by: (1) meters; (2) Pitot tubes; (3) initial and discharge pressure and size and length of pipe computation; (4) computation of well output from size of outlet or casing and minute pressure.

The meters either actually measured the volume of gas by passing all of it through bellows of a given capacity which were filled and emptied by automatically operating valves, or they measured a small part of the flowing volume on a proportional basis upon which the total could be easily calculated.

The Pitot Tube

The Pitot tube has a short right angle bend and is placed vertically in the moving body of gas with the bent part lowermost and the mouth normal to the direction of flow to measure the velocity of the gas. The upper end of the tube communicates with one branch of a glass U-tube partly filled with water (or other fluid), and the other branch of the U-tube is connected to an opening in the pipe line, the plane of which is at right angles to that of the opening into the Pitot tube. The branch of the U-tube connected with the Pitot tube will show a higher pressure than that connected with the pipe line opening due to the velocity and density of the gas at the Pitot tube opening in the pipe line gas current. The formula, as determined by Prof. S. W. Robinson is:

$$Q = 1{,}690d^2\sqrt{h\left(1+\frac{p}{15}\right)},$$

in which

Q = number of cubic feet of gas flowing in pipe line per hour.
d = diameter of pipe line in inches.
p = static pressure of gas in pounds.
h = difference in level of water in U-tube measured in inches.

The above formula is for a gas of .6 specific gravity at 50° F. and for reduction to gas of any other gravity multiply by the square root of 0.6 over the specific gravity of the gas.

The volume of gas passing through a pipe line was computed from the pressures at two given points as follows:

$$Q = 40d^2\sqrt{\frac{(p_1^2-p_2^2)d}{L\,D}},$$

in which

Q = cubic feet of gas passing in one hour.
p = absolute pressure in pounds (gauge pressure + 15) at initial point.
d = diameter of pipe in inches.
L = length of pipe between points in miles.
D = density of the gas.

Forrest M. Towl devised a slide rule for determining at sight the discharge of any pipe line, by this method.

To compute the output of a gas well the following calculations were made:

$$Q = \frac{d^2 \times 3.1416 \times L}{4 \times 144} \times \frac{p}{15} \times 60 \times 24$$

in which

Q = quantity in cubic feet of gas discharged into open air in 24 hours.
d = diameter of the hole in inches.
L = depth of the hole in feet.
p = pressure in pounds shown by gauge one minute after closing gate (less any pressure gauge might have shown before closing gate).

Reduced to its lowest terms the above formula becomes:

$$Q = 1/2\ d^2Lp, \text{ or}$$

the output of a well in one day is equal to one-half the product of the square of the diameter of the hole in inches by the depth of the hole in feet by the pressure in pounds per square inch.

Home Pressure Regulator

It was not until 1893 that the first patent was issued in the United States for a home regulator to maintain proper gas pressures, and it was not until the beginning of the present century that turning on the gas jet ceased to be a venture which might result in a roar of gas from the stove, or a feeble flow of no use at all. The balanced valve, diaphragmed regulators took much of this early hazard from the industry, and soon it was no longer necessary for the gas companies to maintain first aid stations for customers, and publish names of the company doctors and surgeons.

After the natural gas pipe lines began to move farther and farther afield to reach new sources of supply and to reach more customers, the pressures in these lines were increased by means of compressors. At the city gate the gas might arrive with a pressure of 150 pounds or more, and the problem was first to reduce this pressure for the comparatively low pressure city mains, and second, to reduce the city pressure to the 2 or 3 ounces necessary for domestic consumption. Disasters hastened the installation of equipment to handle high pressures, but for many years the gasometer stood between the gas company and heavy damage claims. The oil seals would blow out and high pressure would be thrown into low pressure systems. M. B. Daly, of the East Ohio Gas Co., recounts that some time after the first long distance gas line was laid to Buffalo from the McKean-Elk gas pool, a gasometer failed and damage to St. Paul's Episcopal cathedral cost the gas company $50,000. This accident, Mr. Daly says, resulted in the invention of the safety device now universally used, designed by John Klein of Oil City. It is interesting to note that on February 25, 1891, the Treasury Department in Washington approved the action of the Buffalo collector of customs in imposing an ad valorem duty on natural gas imported from Canada.

Canonsburg, Pa., pressure control station of Pennsylvania Gas Co., in 1890. At that time the problem was to keep the pressure down

Pipe Line Extensions

In 1891 the Indiana Natural Gas & Oil Co. laid two parallel 8-inch pipe lines 120 miles from wells near Greentown, Ind., to Chicago. These were made up of wrought iron screw coupled lengths, and the initial pressure imparted by mechanical compression was 525 pounds. These lines marked the real beginning of long distance high pressure natural gas transmission in the United States.

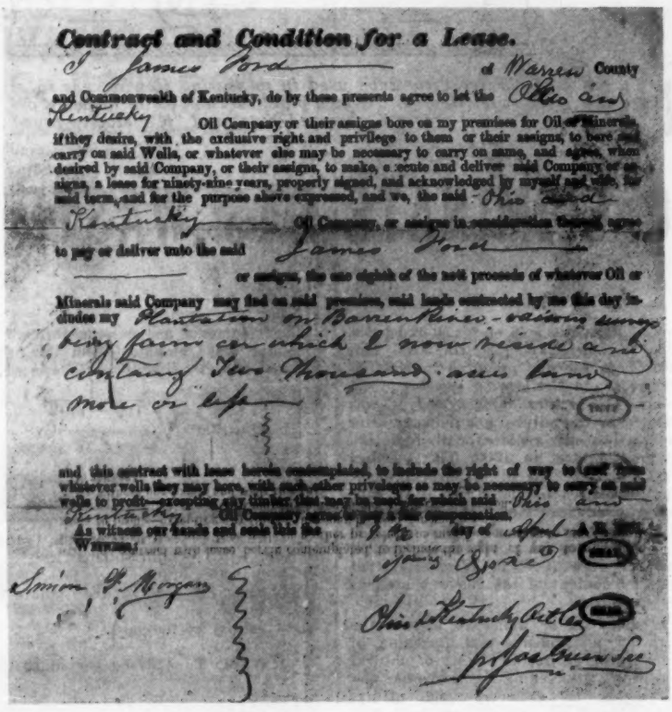
It was in this same year that S. R. Dresser, who had invented a joint of revolutionary design for gas pipe lines, had to lay his own line to prove the superiority of his coupling. He laid 5 miles of

5⅝-inch line from the Malta and McConnellsville Gas Co. plant at Malta, Ohio. The original couplings weighed 110 pounds apiece. The Dresser couplings greatly facilitated the laying of properly constructed gas pipe lines, and their first use is a noteworthy date in the history of natural gas. In 1896 United Natural Gas Co., of Oil City, laid 8 miles of 12-inch Dresser coupled line to Buffalo, and in 1898 and 1899 the company added larger and longer Dresser-coupled lines. It was in 1894 that steel pipe began to appear in the transmission of natural gas. The use of gas compressors in the Murrysville Field in Pennsylvania in 1890 may be said to have established their use throughout the industry because of the flexibility of operation provided. In 1898 the Ingersoll-Rand catalog mentions the use of Ingersoll-Sergeant piston inlet air compressors for natural gas transmission near Fostoria, Ohio. In 1903, Hope Natural Gas Co., at Hastings, W. Va., built the largest station which was equipped with two 4,500-horsepower Snow gas engines. It is interesting to note that the gas engine had by this time become one of the industry's important consumers. In 1890 a famous name, that of William M. Crane, became associated with industrial expansion of the natural gas industry. The Crane company obtained patents on a number of industrial appliances in that year.

Western Operations

Among the field developments it should be noted first, in the light of later history, that 1904 marked the beginning of the Bartlesville, Okla., operations, and the drilling of the first well, to a depth of 450 feet, in the White Point area on the Texas Gulf Coast, on the north side of Nueces Bay. High points and dates in field operations during the third period may be listed as follows: In 1890 the first gasser was struck near Sistersville, W. Va. In the same year Guffey & Galey, of Pittsburgh, piped natural gas into Neodesha, Kans., and four years later sold out to Forest Oil Co. which was to become the Prairie Oil & Gas Co.

In 1901 a shallow gas field was discovered in Menefee County, Kentucky, but was not piped to Lexington until 1906. This field has proved of particular interest to modern operators. The field was nearly exhausted in about four years and the Lexington line had to be extended 100 miles to the West Virginia gas fields. The company experimented with the Menefee gas reservoir and after 10 years established the procedure of storing gas from the West Virginia fields in the old reservoir during the low load summer months, and drawing from the Menefee storage during the winter. In 1893 gas was struck near Iola, Kans., at a depth of 840 feet. In June of the same year Barnsdall struck a large gasser on McKinnon Creek, 10 miles east of Eureka, W. Va. In October No. 1 Swagler, 12 miles east of Washington, Pa., came in as "the largest gasser in the world," and the roar could be heard 15 miles.



Contract and Condition for a Lease.

I James Ford of Warren County and Commonwealth of Kentucky, do by these presents agree to let the Ohio and Kentucky Oil Company or their assigns bore on my premises for Oil or Minerals, if they desire, with the exclusive right and privilege to them or their assigns, to bore and carry on said Wells, or whatever else may be necessary to carry on same, and agree, when desired by said Company, or their assigns, to make, execute and deliver said Company or assigns, a lease for ninety-nine years, properly signed, and acknowledged by myself and wife, for said term, and for the purpose above expressed, and we, the said Ohio and Kentucky Oil Company, or assigns in consideration thereof, agree to pay or deliver unto the said James Ford or assigns, the one eighth of the nett proceeds of whatever Oil or Minerals said Company may find on said premises, said lands contracted by me this day includes my Plantation on Barren River - adjoining Sweeney farm on which I now reside and containing Two Thousand acres land more or less

and this contract with lease herein contemplated, to include the right of way to and from whatever wells they may bore, with such other privileges as may be necessary to carry on said wells to profit—excepting any timber that may be used for rebuilds said Ohio and Kentucky Oil Company agree to pay a fair compensation.

As witness our hands and seals this the 7th day of April A.D. 1861

Witness: Simon B. Morgan

James Ford (SEAL)

Ohio & Kentucky Oil Co. (SEAL)

by Jos Brown Sec

Petroleum lease executed in 1861

In industry's most famous well came in for 100,000,000 feet a day on October 2, 1894, 15 miles east of Sistersville, in Tyler County, West Virginia. This was the Big Moses, which defied attempts to cap it for more than a year. On May 14 what was reported to be a "huge gasser" was struck by the Chicago Oil Co. at 385 feet in the shale rock of Washington Township, Hancock County, Ohio.

In 1895, January 8, Devonian Oil Co. sold its McKean-Elk County gas holdings to United Natural Gas Co. of Oil City. On May 29 an experimental well drilled in the city of Butler, Pa., got gas at 986 feet. On July 18 Carnegie Natural Gas Co. struck a large gasser on the W. J. Bryan farm, 7 miles northeast of Cameron, Greene County, Pennsylvania. On December 16 came the big gas strike on the Ewing farm, Aleppo Township, Greene County. In 1897, on December 9, South Penn Oil Co. got its huge gasser on Piney Fork, Wetzel County, West Virginia. In 1903 gas was discovered in Brenning Basin, near Douglas, Wyo., but it was not until 1909 that the gas was piped to nearby towns, and Casper did not receive this gas until 1920. It is interesting to note that as late as 1902 a gas well was abandoned by drillers seeking oil in the Ventura Avenue Field in California.

Number of producing gas wells in the various states at the close of the third period in 1904 was as follows: Pennsylvania, 6,352; Ohio, 425; West Virginia, 7½; Indiana, 740; New York, 148; Kansas, 171; Kentucky and Tennessee, 44; California, 19; Indian Territory and Oklahoma, 42; Arkansas and Wyoming, 4; Colorado, 4; South Dakota, 12; Texas and Alabama, 8; Missouri, 25; Illinois, 66; Louisiana, 4; total, 2,139.

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TRANSPORTATION—ERA NUMBER 4 1904-1919

INTRODUCTION OF WELDING IN CONSTRUCTION AND GASOLINE LINES FEATURE OF FOURTH ERA

TWO outstanding events in pipe line transportation during the fourth era, from 1904 to 1919, presaged important developments in modern pipe line practice. The first was the introduction of welding in the construction of pipe lines; the second was the construction and successful operation of a gasoline pipe line.

With the improvements made in the manufacture of line pipe, transportation companies began to give more consideration to leakage at joints as it had been found quite frequently that pipe lines in which the pipe was in good condition had to be taken up because of excessive leakage at joints.

The natural gas industry deserves credit for the first employment of welding for pipe lines. In 1911, 1,000 feet of 4-inch, high pressure gas pipe line was acetylene welded and laid in a suburb of Philadelphia, Pa. Early in 1912 the Pacific Gas & Electric Co. of San Francisco installed 5,000 feet of oxy-acetylene welded, 8-inch gas line in San Francisco. The welding in Philadelphia is the first application of the process for such a purpose in this country.

On the job in San Francisco, oxy-acetylene welding was used on every joint of pipe. The line was laid in Geary Street ning to construct from Salt Creek to Casper, a distance of 40 miles. Welders were almost an unknown quantity in the Rocky Mountain area. Mr. Peake finally found a man in Denver who had done some welding in a machine shop. This man had never welded any pipe. Mr. Peake took this man to Casper and hired 40 men to become welders on the gasoline line. None of these men had ever seen a welding outfit. Mr. Peake got a quantity of 3-inch pipe, had it cut into 6-inch nipples and for one month the 40 men, under the supervision of the one welder, did nothing but weld these 6-inch nipples. At the end of the month they were very proficient in the matter of welding 3-inch pipe.

The first pipe line welding job in the United States. Welding 1,000 feet of 4-inch high pressure gas pipe line in a suburb of Philadelphia

at the same time the Municipal Railroad was under construction, and this necessarily caused many obstructions and difficulties, but in every case the welding proved itself equal to the occasion and all difficulties were surmounted.

To insure against the possibility of the welding not extending through the entire thickness of the pipe, the ends of the lengths of the pipe to be welded were left about one-eighth inch apart and the operator worked with a rod of three-sixteenths inch Norway iron in his left hand. The iron was melted into the joint to take care of the gap and also to build up the metal around the joint. The metal at the joint was thicker than the pipe. To prove that the weld was stronger than the pipe itself sample welds were made and the pipe afterwards was flattened and beaten until it was broken. In every case the break occurred back of the weld in the pipe and not across the joint.

First Gasoline Line Welded

Following this successful experience in California, A. W. Peake, now vice president in charge of production of the Standard Oil Co. (Indiana) and then an engineer of the Midwest Refining Co. at Casper, decided to weld the 3-inch gasoline pipe line the company was plan-

Mr. Peake then took the outfit to Salt Creek, and in the fall of 1917 started construction of the 40-mile, 3-inch gasoline pipe line from the gasoline plant of the Midwest Refining Co. at Salt Creek to Casper. This line was finished in December, 1917, and gasoline was pumped through it on January 1, 1918. This was the first gasoline pipe line in the United States and operation of the line was successful from the start. It also was the first oil or gasoline pipe line to be welded in the United States. It antedated by more than 10 years the second gasoline pipe line to be constructed in this country.

Many of the largest crude oil pipe line systems in the United States were started during this fourth era. Some of the largest companies in the business were organized during this period, and quite an extensive system of pipe lines was built throughout the Mid-Continent, Gulf Coast and Central West area.

During this period trunk lines were built from Oklahoma to Texas Gulf Coast ports and lines were constructed and extensions made to existing lines from the Oklahoma and Kansas fields to the refinery centers in Kansas, Wood River, Ill., and Whiting, Ind.

Start of the Texas Co.

The Texas Co. was incorporated April 7, 1902, in Texas. The pipe line system now owned and operated by the Texas Co. was started by the laying of a 6-inch line from Spindletop, near Beaumont, Tex., to Port Arthur, Tex., a distance of about 20 miles. As new fields were discovered the company's lines were extended, first, from Spindletop to Sour Lake, Tex., a distance of about 20 miles; then from Sour Lake to Saratoga, about 10 miles; then from Sour Lake to Humble, about 50 miles; and from Humble to Houston, about 20 miles. In the latter part of 1907 the company began the construction of its 8-inch line from Humble, then the terminus of its line, to the

Pumping station (center background) of Midwest Refining Co.'s gasoline pipe line from Salt Creek to Casper, Wyo.

Oklahoma oil fields. This line ran practically due north a distance of about 470 miles. An extension of this 8-inch line was later made from Tulsa to Bartlesville, Okla., about 50 miles distant, to reach the shallow oil fields near Delaware and Nowata. Branch lines reach the various producing pools known as Glenn Pool, Flat Rock, Bald Hill, Bird Creek, etc., in Oklahoma. A line was constructed in 1911 from Dallas, Tex., northwest to Electra, Tex., distant about 160 miles.

The company constructed an 8-inch line from Vivian, La., in the Caddo Pool, to Logansport, Tex., about 67 miles long, and a 6-inch line from Evangeline, La., in the Jennings Pool, to Toomey in southern Louisiana, about the same distance. The Texas Co. later constructed an 8-inch connecting line from Toomey, La., to Garrison, Tex., about 28 miles.

Prairie Line to Chicago

In 1905 the Prairie Oil & Gas Co., whose first operations were described in the previous era (1889-1904) constructed an 8-inch line from near Kansas City to Griffith, Ind. (near Chicago), a distance of 440.74 miles. During 1905 the 8-inch line was extended from Argo station to Cherokee station near Ochelata, Okla., and in 1906 and 1907 an 8-inch line was completed from Creek station, near Jenks, Okla., to Cherokee station. This gave a continuous 8-inch line, 673.53 miles long, from Creek station to Griffith, Ind. In 1909-10 an 8-inch line, 89.92 miles long, was built across southwestern Arkansas, connecting with the line of the Oklahoma Pipe Line Co. at the Arkansas-Oklahoma boundary and with the line of the Standard Oil Co. of Louisiana at the Arkansas-Louisiana state line. This gave a through line from the Glenn Pool, in Oklahoma, to the refinery of the Standard Oil Co. of Louisiana at North Baton Rouge, La. In 1913 an 8-inch line was built from Carrollton pumping station, near Carrollton, Mo., to the refinery of the Standard Oil Co. (Indiana) at Wood River, Ill. (near St. Louis). This line was 194.07 miles long. The lines of the Prairie Oil & Gas Co. connected with the Indiana Pipe Line Co. at Griffith, Ind., and with the lines of the Illinois Pipe Line Co. at Wood River, Ill. Shipments of crude were made through the lines of the Prairie Oil & Gas Co. to refineries in the East and on the Atlantic seaboard by transferring the oil at Griffith and Wood River to the Indiana Pipe Line Co. and the Illinois Pipe Line Co., respectively.

The Oklahoma Pipe Line Co. incorporated in Oklahoma in November, 1909, a subsidiary of the Standard Oil Co. (New Jersey), constructed a trunk line from the Glenn Pool, near Jenks, Okla., to the Oklahoma-Arkansas state line, a distance of 156 miles, where it joined with the Arkansas division of the Prairie Oil & Gas Co. The Arkansas division of the Prairie consisted of an 8-inch line, 90 miles long, from the terminus of the Oklahoma Pipe Line Co. at DeQueen, Ark., to the Arkansas-Louisiana state line near Ida, La., where it joined the pipe line of the Standard Oil Co. of Louisiana.

The Standard Oil Co. of Louisiana incorporated in Louisiana April 13, 1909. Its trunk line system, constructed principally in 1909 and 1910, consisted of an 8-inch line, 268 miles long, from its con-

nection with the Arkansas division of the Prairie at Ida, La., to North Baton Rouge, La.

Organization of the Gulf

The Gulf Pipe Line Co. of Texas was organized under the laws of Texas November 30, 1906. The Gulf pipe line system had its beginning with the J. M. Guffey Petroleum Co., a company operating in the State of Texas only. This company had a 6-inch pipe line running from Batson to Saratoga and Sour Lake, where it joined the 8-inch line running from Sour Lake to Port Arthur.

In 1906 the Gulf Pipe Line Co. was organized to connect the Guffey pipe line with the Oklahoma fields. In 1907 an 8-inch line was completed from Sour Lake, Texas, to Watkins, Okla., in the Glenn Pool. Later in the year the entire pipe line system of the Gulf Oil Corp. was unified by the Gulf Pipe Line Co. of Texas taking over all the pipe lines in Oklahoma and Texas. The pipe line property of the J. M. Guffey Petroleum Co. was taken over.

In 1909 the pipe line property in Oklahoma was leased to the newly organized Gulf Pipe Line Co. of Oklahoma.

The Gulf Refining Co. of Louisiana was incorporated in Louisiana December 22, 1905. It owned and operated pipe lines in the State of Louisiana. Its pipe line system connects with that of the Gulf Pipe Line Co.

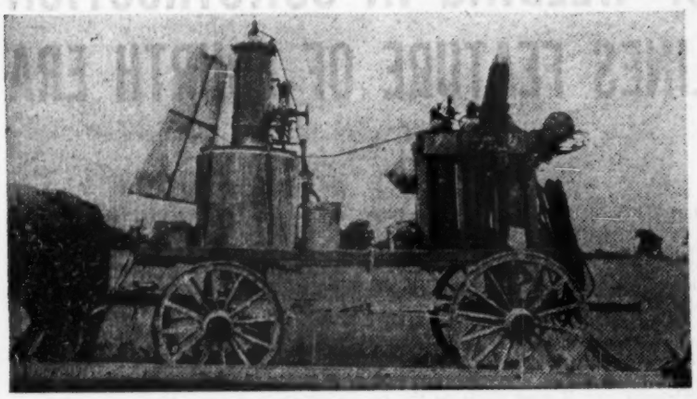
Pipe lines of the Gulf Pipe Line Co. of Oklahoma, Gulf Pipe Line Co. of Texas and Gulf Refining Co. of Louisiana formed an interstate pipe line system, transporting oil from the Mid-Continent and the Gulf coastal fields to refineries of the Gulf Refining Co. of Texas, located at Fort Worth and Port Arthur, Tex.

The Gulf company operated one main trunk line and several lateral lines, including the line from Cushing Station in Oklahoma to Watkins Station which began in 1913. The main line extended from Bartlesville to the Red River where it joined the system of the Gulf Pipe Line Co. of Texas. The Gulf gradually extended its system as various producing areas in the Mid-Continent were developed.

In 1908, when the production of the Bradford and Allegheny Fields was declining rapidly, the Tide Water Oil Co., which was organized in 1907 and which took over the Tide Water Pipe Co., found the production connected to its pipe line was not sufficient for the requirements of its Bayonne refinery. At this time, Illinois had become a prominent factor in crude oil production. The Tide Water Oil Co. extended its pipe line from the Pennsylvania fields to the producing area in southern Illinois, a distance of 546 miles. This extra production, together with the promise of a good output from properties the company had secured around 1913 in Oklahoma, caused the company to loop its eastern line for a distance of 129 miles. Improvements were made on the pumping stations and all stations were equipped with internal combustion oil engines.

Magnolia Started in 1911

At the time of its organization, April 24, 1911, the Magnolia Petroleum Co. owned gathering lines in the Henrietta, Petrolia and Corsicana Pools in Texas and a trunk line system, about 30 miles long, from the Beaumont refinery to the port of Sabine. Prior to April, 1912, all the crude oil from Henrietta and the Petrolia Pools and the crude and refined products from Corsicana were transported in tank cars. In the early part of 1912 a main 8-inch trunk line, extending from Beaumont, by way of Corsicana, to Electra in Wichita County, Texas, was completed. In the spring of 1914 an 8-inch line was finished, extending from Alboard, Texas, to the Red River to connect with the Oklahoma line of the Magnolia Pipe Line Co., which had been incorporated in the State of Oklahoma December 16, 1913.



Early type of acetylene welding outfit

In 1915 an 8-inch line was built by the McMan Pipe Line Co. from the Cushing Pool in Oklahoma to Addington, Okla., where it joined the 8-inch line of the Magnolia Pipe Line Co.

The total distance covered by trunk pipe lines operated in the Mid-Continent Field in 1914 was 4,320 miles. The total length of lines and loops was 6,593 miles, of which 6,058 miles were main lines and 535 were lateral lines.

Sinclair (Later Stanolind) Incorporated

The Sinclair-Cudahy Pipe Line Co. was incorporated April 24, 1916. At this time the pipe lines of the Milliken Pipe Line Co., the Cudahy Pipe Line Co. and the Chanute Refining Co. were purchased and consolidated into one system.

During the year following May 1, 1916, the Sinclair-Cudahy Pipe Line Co. constructed a gathering system in northeastern Oklahoma, and this was extended to the Bald Hill, Stone Bluff, Bixby and Kiefer sections of Oklahoma, and to Eureka, Toronto and Eldorado districts in Kansas. The lines laid consisted primarily of 2, 3, 4 and 6-inch pipe.

A trunk line from Drumright, Okla., to East Chicago, Ind., was authorized November 9, 1916. A 6-inch line was laid from Drumright to Humboldt, Kans. The main line from Humboldt to East Chicago was an 8-inch line. At the same time a 6-inch line was built between Eldorado and Humboldt, Kans.

To get increased capacity during the war, the company built an 8-inch line from Drumright to Humboldt and a 6-inch line from Humboldt to Freeman, Mo. The company extended its gathering system and a 6-inch line was constructed from Healdton, Okla., to Drumright, this being completed July 9, 1918.

With the development of the Ranger Field in Texas in 1918, the company extended its trunk line system from Healdton to Ranger, 150 miles of 8-inch line.

In 1919 an 8-inch line was built from Healdton to the newly developed Burkburnett Field.

In the meantime the 6-inch north from Healdton to Humboldt was paralleled by an 8-inch and the 8-inch from Humboldt to Kansas City by a 6-inch.

Extensions to the gathering system were made to tap various pools developed in Kansas, Oklahoma and Texas.

Humble Began With Ranger Boom

The Humble Pipe Line Co. was started during the Ranger boom in 1918 when it constructed an 8-inch line from Comyn in Eastland County, Texas, to Webster on the Gulf Coast below Houston. In the coastal region 8-inch lines were laid to West Columbia and Pierce Junction. The company early entered the Mexia and Powell Fields and laid lines to connect with its trunk line at Hearne, Texas. This company rapidly extended its lines to the more important fields in Texas, a 135-mile extension being laid from Comyn to the Big Lake Field in Reagan County and 110 miles from the Duval-Jim Hogg County fields to the Gulf Coast at Ingleside, near Corpus Christi.

Activity in California

The year 1904 was one of considerable activity in the extension of transportation facilities in California. The oil business was now getting away to a really good start. Oil prices were on the increase and important operations were begun in several quarters as follows:

1. Another pipe line outlet was provided from the Coalinga Field. The Coalinga Oil & Transportation Co. laid 110 miles of 6-inch to Monterey.

2. The same interests that built the Coalinga-Monterey line took over the Alcatraz Refining Co. lines from Santa Maria to Gaviota and put them into service making oil deliveries to tank steamers. Considerable oil was then being produced in the Santa Maria Field and an adequate outlet was very desirable.

3. The Union Oil Co.'s remarkable Hartnell gusher came in at Santa Maria (at 12,000 bbls. per day), and this company then began the construction of its 33-mile 6-inch line to Port San Luis (also known as Port Harford).

4. A 2,000-bbl. flowing well came in in the Salt Lake Field and started important activities in this district. An outlet for the oil was provided by the Amalgamated Oil Co. It built a line to a newly constructed refinery in Los Angeles.

Second Long Line

The Coalinga-Monterey line was the second long oil artery in California. Unlike the pioneer line, it traversed very rough country. At one point it reached an elevation of about 2,600 feet.

At the Salinas River crossing a 560-foot cable suspension span was constructed (since eliminated by rerouting the line across the river).

This system operated for about a year with only four pump stations. Intermediate plants then had to be provided to take care of the rapidly increasing Coalinga production. (Subsequently—about 1910—the transportation of heavy oil became necessary, and heaters were installed at each station. Heating facilities were also placed at points about half way between the pumping plants.)

The laying of the Coalinga-Monterey line was part of an interesting piece of strategy. Capt. William Matson, who was instrumental in its construction, had sugar interests in Hawaii. Oil was in demand there for fuel purposes. By transporting oil to the island and sugar on the return trip, he kept his ships loaded both ways.

By 1904 more than a score of oil refineries were operating at widely scattered points in California.

Development in 1905

In 1905 the Pacific Coast Oil Co. (Standard Oil Co.) laid an 8-inch line from Orcutt, in the Santa Maria Field, to Port San Luis (Port Harford). It was taken up in 1918 and relaid elsewhere.

The Orcutt-Port San Luis line was the scene of an unusual adventure early in 1909. It developed a bad leak at the broad, shallow Santa Maria River crossing just at the time the spring freshets were at their height. The leak was near one of the banks and the repair crew had to have an upstream dam to facilitate its work. Men, anchored by ropes, drove a line of posts out from the bank, the line being pointed slightly downstream. Near the top of the posts they suspended two lines of cable and then with great difficulty attached large bundles of brush and even small trees to the cables. The plan was to suddenly drop the entire bulwark and divert the flow of water around the leak location. The scheme worked, but in a way quite different from that expected. The wornout men were dumfounded to observe that instead of only a small portion of the stream being diverted, the entire torrent changed its course and started off across the flat sandy country. Everybody concerned had visions of free board at government expense until they finally learned that the land that was inundated had no value for farming purposes.

The Associated Oil Co., which since its organization by various producers in 1901 had had only producing interests, in 1906 took over the Coalinga Oil & Transportation Co.'s line to Monterey and also the National Oil Transportation Co.'s 3-inch and 4-inch line running from Santa Maria to Gaviota (both then con-

Crew of Prairie Oil & Gas Co. laying pipe line across the Des Moines River in May, 1906

trolled by the Matson interests). The Associated Oil Co. now began to take its place as an important factor in all branches of the oil business.

At this time the Pacific Coast Oil Co. was consolidated with the Standard Oil Co. of Iowa (both controlled by the Standard Oil Co. of New Jersey). The new concern began to do business under the name Standard Oil Co.

Naphtha comes from the Persian, nafata, to exude. Russians call all petroleum naphtha.

The Roman writers Strabo and Pliny, in the time of Christ, called burning surface oil deposits, bitumen and liquid candidum.

During the first half of the nineteenth century, salt wells were often abandoned when evil-smelling petroleum appeared.

Kern River Line

The Associated Pipe Line Co., owned jointly by the Associated Oil Co. and the Southern Pacific Railroad Co., built an 8-inch line from the Kern River Field to Port Costa, on San Francisco Bay, in 1907. The pumping stations were located a little under 30 miles apart, just as were the stations on the pioneer 8-inch line. It was expected that by means of a special innovation ("rifled" pipe) the heavy Kern River oil could be handled satisfactorily with this long station interval. The pipe had been constructed with a spiral twist, and arrangements were made for introducing 10 per cent of water with the oil. Previous tests had indicated that the mixture would maintain a spiral whirl and the water would be thrown against the wall of the pipe, thus providing a relatively nonviscous lubricant for the inner core of sticky oil. Obstacles to the successful operation of this scheme developed in the course of a few years, and intermediate pumping stations with heating facilities became necessary (1916).

During 1907 the Standard Oil Co. built an 8-inch line into the Midway Field. This provided the first pipe line outlet from the prolific Midway district and was an outstanding factor in opening up the field.

An important auxiliary activity in the development of the Midway area was the laying of a large mileage of water lines. The semidesert nature of San Joaquin Valley oil country makes the construction of extensive water systems a matter of vital importance.

The Standard Oil Co. extended its system (8-inch) into the McKittrick Field in 1908. The Santa Maria Field, now at its peak production, was given a third large outlet. The Associated Oil Co. laid an 8-inch line to Gaviota. The original 3-inch and 4-inch lines laid by the Alcatraz Refining Co. were removed.

Midway Field Active

The gusher period in the Midway Field opened in 1909-10, and the spotlight of activity was thrown with full intensity on this area. No more spectacular event has occurred in the producing end of the oil business than the blowing in of the historical Lakeview (Union Oil Co.) gusher near Maricopa in 1910. During four months of its relatively short life it is said to have produced an average of 50,000 bbls. per day.

Further increases in production were taking place in the Coalinga Field at the same time, and the first productive well was brought in in the Lost Hills Field.

The following big pipe line work was done:

1. The Producers Transportation Co., assisted by the Union Oil Co., laid an 8-inch line to Port San Luis from a point in the north McKittrick district and feeders were laid from Sunset, McKittrick, Coalinga and Kern River. A refinery was constructed at the pipe line terminal (Avila).

2. During 1909 the Associated Pipe Line Co. built an 8-inch "rifled" branch north from Coalinga to its Kern River-Port Costa trunk line. From this junction northward to Port Costa an 8-inch line (also "rifled") was laid parallel with the previous 8-inch. A year later the Associated Pipe Line Co. connected the McKittrick and Coalinga districts with an 8-inch line.

3. The Standard Oil Co.'s trunk from its junction with the Coalinga line system was enlarged northward.

Producers Transportation

The Producers Transportation line attracted considerable attention because it was the first (and only) line that had been built through the co-operative effort of producers who desired an independent outlet for their oil. The producers (who had organized in 1904 as the Independent Oil Producers Agency) joined with the Union Oil Co. in financing the project. The line was the second in California to cross a mountain range, one point in the line being at an elevation of about 1,300 feet. Notwithstanding the rough character of the country, the system was installed in very rapid time. About 1,000 men laid the line and installed 15 pumping stations, with the necessary heating and other equipment, in five months' time—excluding delays caused by bad weather. Four tong gangs and two ditch gangs were used. A tong gang record is said to have been achieved—283 joints of 8-inch (1.1 miles) in nine hours.

The transportation of material for this work was carried out in the face of the most discouraging difficulties. Makeshift roads through rugged country had to be contended with. Seventeen hundred head of horses and mules are said to have been used. Fourteen-up mule teams were a common sight. On some of the curving mountain stretches the skinner had only half his string in full view.

Six tractors were utilized here in addition to the teams. Toward the end of the job, one 3½-ton motor-driven truck was tried out. It amazed the old-timers by covering 80 miles in one day. Many present-day executives can recall how, at this time, the motor truck and automobile first gave promise of speeding up pipe line work.

In 1909 the Southern Pacific Co. acquired an extensive interest in the Associated Oil Co.

Increased Capacity

As a result of the activity in the Midway and Coalinga districts, the Standard Oil Co. in 1911 increased the capacity of its trunk line system to San Francisco Bay and substituted, for original duplex pumps, cross compound, noncondensing, triplex oil end, flywheel units (two 50,000 B.P.D. pumps at each of 21 stations).

The Associated Oil Co. completed an 8-inch line between the Sunset and McKittrick districts. The line was taken over by the Associated Pipe Line Co., which thus came into possession of a continuous connection between the Sunset Field and Port Costa. The water injection system which had been used for the previous two years in the "rifled" section between Coalinga and Port Costa was abandoned and intermediate stations with heaters were installed.

Tanker discharging cargo of fuel oil through what is claimed to be first submarine pipe line laid on Pacific Coast, located at Tocopilla, Chile, early in 1908

Production in southern California had increased to a point where the Standard Oil Co. felt justified in abandoning its tank car transportation from loading racks located at the end of short pipe lines, and a 6-inch line 23 miles long was laid from Northam to a newly constructed refinery at El Segundo. (As in the case of other main line systems in southern California and elsewhere, this system has since received considerable additions.)

In 1912-13 the Coalinga Field reached its peak and production was rapidly increasing in the Midway district. The following important pipe line additions were made:

1. The General Pipe Line Co. (owned by the General Petroleum Co., which had just been organized on the foundation built by the Esperanza Consolidated Oil Co. during the 12 preceding years) built an 8-inch line from the Midway Field to a newly constructed refinery in Los Angeles, and a branch from this line was laid to railroad fuel oil storage at Mojave. A total of 212 miles of 8-inch was involved. (The idea of burning fuel oil in locomotives was introduced many years before by the Union Oil Co. The Santa Fe Railroad Co. lent the company a locomotive and experiments were conducted at the Santa Paula refinery. An extremely important market for residuum was developed in this way.)

2. In making further additions to its trunk line to Point Richmond, the Standard Oil Co. laid the first 12-inch pipe in California.

3. The Standard Oil Co. built an 8-inch trunk line branch into the Lost Hills Field (the discovery well having come in two years before). It also began the construction of a refinery in Bakersfield to relieve pipe line congestion and to supply the local market.

Additions of 12-inch

Further additions (more 12-inch) were made to the Standard Oil Co.'s trunk line systems to Point Richmond in 1914. This work was done on the division lying south of the junction with the Coalinga branch. The previous 12-inch work had all been done on the north end.

The Valley Pipe Line Co. (Shell Co.) laid a 170-mile line from the Coalinga Field to a newly constructed refinery at Martinez on San Francisco Bay in 1915. (The Shell interests had, in 1913, acquired considerable oil production at Coalinga through its purchase of the "California Oil Fields, Ltd.," which had been organized in 1901.) Eleven stations, with oil-heating facilities, were constructed, the average station interval being about 15 miles. The first 10 miles of pipe in each station interval was 8-inch, the remainder being 10-inch. In this way the oil was given an opportunity to flow in a larger pipe, where its temperature was relatively low and its viscosity correspondingly high. As in the case of all previous trunk lines, noncondensing pumping units were employed, the exhaust steam being used for heating the oil.

This line was the first one in California on which labor-saving machinery was used to any considerable extent. Ditching and pipe-screwing machines were employed and special devices were developed for applying an asphaltic protective coating to the pipe, and for the backfilling work. The screwing machines (California type) are said to have put up as much as 1.65 miles of 8-inch in nine hours, the 10-inch record being 1.08 miles.

In 1917 the Montebello Field in southern California came in. It provided sufficient production to warrant the immediate installation of a 6-inch branch line from the Standard Oil Co.'s Northam-El Segundo system. The Lost Hills Field reached its peak this year. The Union Oil Co. acquired full ownership of the Producers Transportation Co.

In 1918 the Valley Pipe Line Co. was dissolved and its properties were merged with the Shell Co. of California.

First Submarine Line

The first submarine line laid along the Pacific Coast was constructed early in 1908 at Tocopilla, Chile. The line consisted of several hundred feet of rubber hose and was used to carry fuel oil from tankers to the terminal on the dock.

The first pseudo-scientist who came to Western Pennsylvania in 1860, threw the populace into a panic when he proposed shooting a white-hot bolt into the bowels of the earth through an iron pipe, thus igniting inflammable gases that would explode and lay bare subterranean reservoirs of oil. His lynching was prevented by authorities who warned him to stop trying to undermine not only the foundation of society, but also the very ground on which society subsisted.

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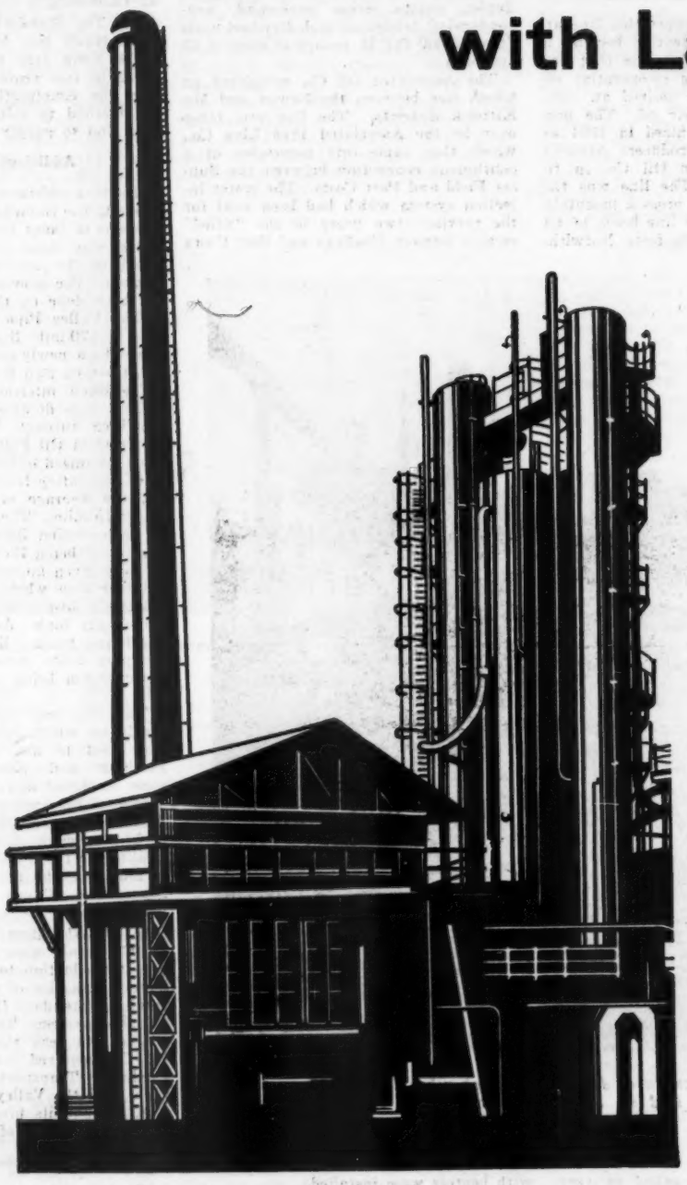

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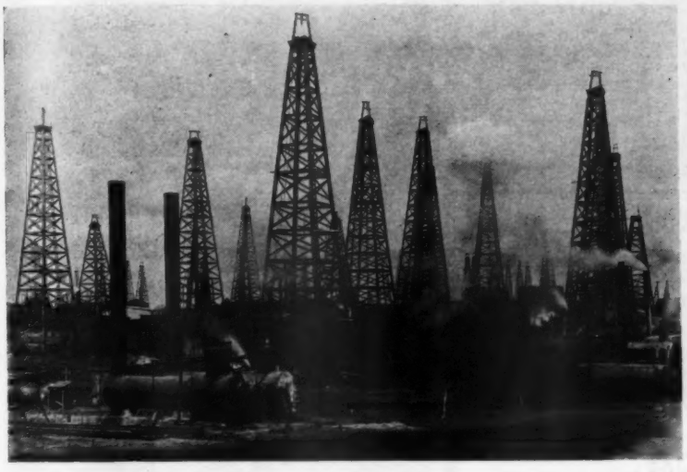
INCREASED DEMAND FOR GASOLINE DURING FOURTH ERA STIMULATED DEVELOPMENT IN NUMEROUS FIELDS



View of the northwest part of the Burkburnett Pool, Texas

Central power operating in an old California shallow field

DEVELOPMENT—ERA NUMBER 4 1904-1919

This period of the petroleum industry witnessed the more rapid expansion of business in every department due largely to the very rapid increase in the use of automobiles in this country. This increased demand for gasoline is reflected in the greater number of new fields opened in this country. For each 15-year period since 1859 there was an expansion in the number of new fields as indicated by the following table:

New fields opened—From	To	No.	Accumulative	Increase rate over previous period—Number	Percentage
1859	1874	85	85	. .	. .
1875	1889	177	262	92	108
1890	1904	381	643	204	145
1905	1919	591	1,234	210	55
1920	1934	916	2,150	325	55

While the rotary outfits gained a place in some areas during this period most of the wells were drilled with cable tools. R. E. Collom, in U. S. Bureau of Mines Bulletin 201, "Prospecting and Testing for Oil and Gas," published in 1922, states:

"Approximately 100,000 of the 109,000 wells estimated as completed in the United States during 1914-1918 were drilled with cable tools, which are used in all Eastern fields, the Mid-Continent Field, Rocky Mountain fields, part of Texas and Louisiana, and for all pioneer work in California. Cable tools are especially adapted to prospecting."

Approximately 303,017 holes were completed during the 1905-1919 period, of which 222,481 were reported as oil wells. The percentage of dry holes to oil wells was approximately 26.5. This is the first period during which over 20,000 holes were started each year.

The activity moved westward and the fields of Illinois, Oklahoma, Kansas, Texas, and California were reported in ever-increasing numbers. In the East many new fields were discovered in West Virginia, Kentucky and northeastern Indiana during the first half of the period.

Wildcat drilling in the Mid-Continent area resulted in the opening of several pools of major importance. The Glenn Pool in Tulsa County, Oklahoma, was discovered in 1905 and by 1907 its production was flooding the market and had caused a break in posted crude oil prices.

To take advantage of the great volumes of oil made available by the opening of the Glenn Pool the Gulf Pipe Line Co. laid the first pipe line from Oklahoma to the Gulf Coast in 1907.

This flood of oil had a tendency to slow drilling some for a time but in 1911 Electra and Burkburnett, North Texas, were discovered although the output of oil from those fields did not reach its peak until several years later. The discovery of oil in this area did stimulate wildcatting and resulted in a number of new pools being opened.

The great Cushing Field, in Oklahoma, was opened in 1912 and in 1914 its flood of oil again broke the market for a time until the greater demand created by the World War took up the surplus and caused prices to increase.

The anticipated increased demand for oil caused by the World War resulted in great drilling activity in Oklahoma in 1914 and 32 new fields are reported discovered in that year.

The discovery of oil near Eldorado, Kans., in 1914 is one of the first fields credited to geology. The state geologist of Kansas and his son outlined the dome at Eldorado and recommended the location of the first test near its apex where the town had bought a block of acreage but it proved dry and later led to the opening of the field by the Empire Oil & Gas Co. which had taken over the lease for a small sum and the agreement to drill three wells.

Later the gushers of the Trapshooter lease were producing 10,000 bbls. per day and the Empire Oil & Gas Co. had expanded its geological staff from 2 or 3 men to over 200 and had field parties active over a large part of eastern Kansas. Some new fields were opened as a result of this intensive search, but the large geological organization was not held together long and geologists brought to the Mid-Continent area by the Empire Oil & Gas Co. moved into other parts of the Middle West and many of them were responsible for the opening of many new pools throughout the entire region.

The geological work done in Kansas near Eldorado was not the first use of geology as applied to petroleum search in the Mid-Continent but the publicity given the Kansas fields created interest in this science and gradually more and more operators employed geologists, either as consultants or on their regular staff.

H. B. Goodrich was the first geologist to engage in commercial petroleum work in Oklahoma when he went to Ardmore, Okla., from Houston, Tex., in 1903 to do field work for the Coline Oil Co., a subsidiary of the Santa Fe Railway Co. Several others followed Mr. Goodrich but it was not until 1913 that petroleum geology was permanently established and recognized in the Mid-Continent fields. E. W. McCrary arrived in Tulsa on January 1 of that year and organized the geological staff for Guffey and Gillespie. Planetable mapping developed by W. T. Griswold and others of the U. S. Geological Survey in the Appalachian fields was introduced and field parties mapped several structures later drilled with the discovery of oil and gas beneath.

Subsurface mapping of oil fields was also introduced by the U. S. Geological Survey in maps of Healdton in 1915 and gained favor with many of the geologists who put it to practical use in their work and one important contribution resulted from this application was the recognition of the Ordovician as a producing horizon. A report on this work was published in 1921.

The work of the geologist caused the production men to drill deeper holes with the result that deeper producing horizons were opened in Oklahoma, Kansas and many other oil-producing states. This type of drilling called for heavier equipment and the manufacturers immediately responded with rig irons and power units suited to the greater depths.

In 1917, near the end of this fourth period, the 6-inch California pattern rig irons began to be used in the Mid-Continent fields and by the end of the period, or in 1919, the demand for this type of equipment was so heavy that manufacturers could not fill the rig builders' orders. Many new manufacturers entered the rig iron business because of this great demand for the heavy irons, but even the added capacity of plants did not keep pace with the rig-building activities and many locations were not drilled during 1919 because of lack of material and men.

Enter the Petroleum Engineer

While it is difficult to state definitely who was the first engineer to be employed by a producing company to assist the production superintendent in the drilling of wells and producing same, it seems to be well established that engineers were first used in the production of oil during the fourth period of the industry's growth. This statement is not meant to imply that prior to this time no engineers had been engaged in oil production. Many well-known operators had engineering training and naturally they used this knowledge in carrying on their business.

There is this distinction to be made—prior to the fourth period the producer had looked largely to the manufacturers to supply him with suitable equipment for drilling his wells and producing same. The production superintendent for the larger companies or the owner of the smaller outfits did the ordering of machinery and equipment and he also supervised its installation on the lease.

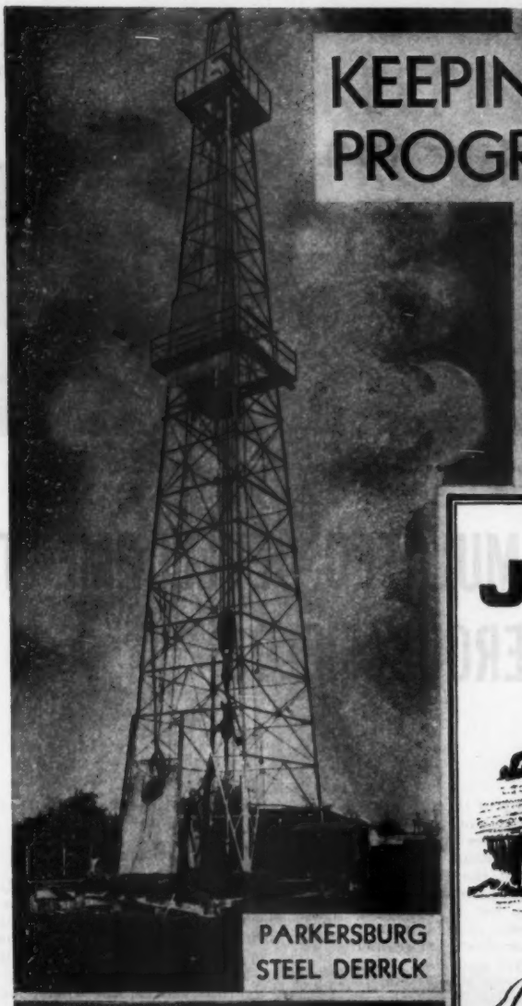
Much of the equipment used was made from wood and the parts made of iron and steel were standardized excepting where the operators had individual ideas and ordered special parts to meet their requirements.

The principal skilled labor of the oil fields was divided into three main classes, rig builders, drillers and tank builders. Roustabouts and helpers served all three groups and when the wells were put on production the pumpers or lease men handled the equipment and serviced the wells, but only after the principal items of equipment had been installed by the other crews.

There were skilled workmen in all oil fields who worked as blacksmiths, machinists, pipe fitters and in the various building trades, but they were not looked upon as the "oil field workers," the men who drilled for and produced the oil that was so essential to all other departments of the industry.

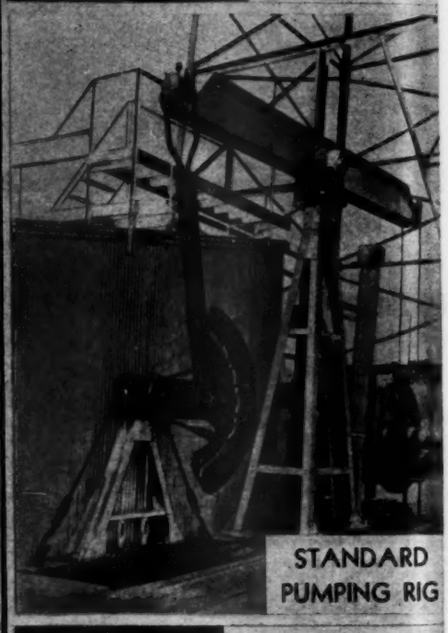
The early petroleum engineers were not employed as such but rather as mechanical engineers to assist the production superintendents in any way possible in handling the installation of equipment and keeping it running. They had little to say about the selection of equipment

KEEPING PACE WITH A PROGRESSIVE INDUSTRY



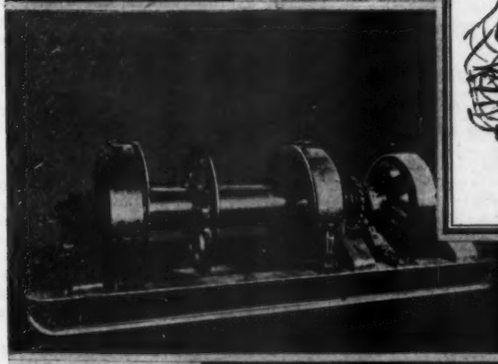
PARKERSBURG STEEL DERRICK

PARKERSBURG BOLTED STEEL TANKS



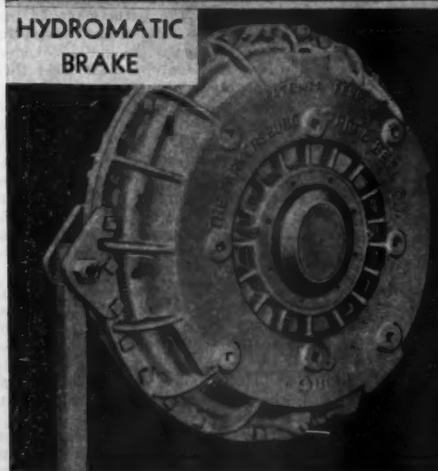
STANDARD PUMPING RIG

SELF-CONTAINED PUMPING UNIT



CHAIN-DRIVEN SAND REEL

HYDROMATIC BRAKE



THE PARKERSBURG RIG & REEL COMPANY

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because the experience of the operators was considered of much greater importance than the technical knowledge of the engineer, and it was very necessary that these new men in the industry be seasoned in the fields by practical experience before they could be entrusted with the decisions of drilling and production problems.

Engineering Problems Grow

The individual operator had reached that stage of his business expansion where it was necessary for him to turn over much of the detailed work to his assistants. The production men had been developed through actual activity in the various fields and were personally known to the heads of the companies and to them were turned over many of the details of getting the oil.

This set-up was all right as long as the companies were engaged in only one branch of the industry, that is, securing the oil, but as many operators branched out into refining, transportation, and marketing the organizations grew so that each department had to have at its head competent men to direct the operations.

Into this changing condition the engineers were introduced and their pathway was by no means rosy at first because they and the production men talked different languages and had different backgrounds so that conflicts were frequent and sometimes ended by the engineer moving on.

But gradually the engineers with tact and diplomacy as well as engineering knowledge won a place in the industry and proved their worth to their immediate superiors and in time the executives came to recognize the advantages to be gained by proper application of engineering principles to production and drilling problems. As one company made a marked success of some venture by the use of engineers other companies were quick to follow the lead until the petroleum engineering departments of the oil companies were firmly established.

Equipment Development Influenced

The actual type of machinery used during the fourth period did not change materially. Cable tools for drilling the holes were still most popular and only a few operators were convinced that the rotaries had any place in the scheme of things. The makers of the rotary outfits were also cautious in their development and it required time and money to change the first crude rotary drilling outfit such as finished the Lucas well at Spindletop in 1901 to the mammoth outfits of this time.

The petroleum engineers had a lot to do with these mechanical changes in equipment. With their specialized training they were able to point out to the manufacturers improvements that could be made that would lower costs in drilling and pumping. Many of the improvements can be traced directly to the results of work done by the field men and the engineers for the oil companies. Patents on many pieces of equipment used regularly today were issued to engineers in the employ of oil companies who were sufficiently skilled in the problems of production together with having the engineering training to recognize where improvements could be made that would be beneficial.

In 1910 the U. S. Bureau of Mines was established with J. A. Holmes as director and under his able management this department of the Government has aided the oil industry in solving many of its most vexing problems. Engineers formerly with the Bureau of Mines now serve the industry as executives and managers of many of the large oil companies in this country and abroad. The experience gained while with the bureau proved a stepping stone for many of those men to enter the employment of the oil companies and their ability carried them higher.

The publications of the Bureau of Mines on subjects related to the oil industry, particularly the production end of the business, are in themselves a complete education for those who desire to learn how to drill for oil and gas and then produce it economically.

The early technical papers and bulletins issued by the Bureau of Mines covered safety measures and reduction of waste which was a step in the same direction. As the activity in Cushing Field was at its height in 1913-1914 and many problems in drilling and production of wells were encountered some of the engineers for the bureau were assigned to this field to help solve them. The use of mud-laden fluid in completing cable tool drilled wells was covered by a paper prepared by J. A. Pollard and A. G. Heggem, and in 1916 J. O. Lewis and W. F. McMurray wrote a bulletin on the use of mud-laden fluid in oil and gas wells.

The trend of the work of the Bureau of Mines engineers during the first few years of its existence was devoted largely to increasing recovery of oil and handling it in proper type storage tanks on the lease. Cost of producing oil was also covered and estimating decline and ultimate production of oil wells also received attention.

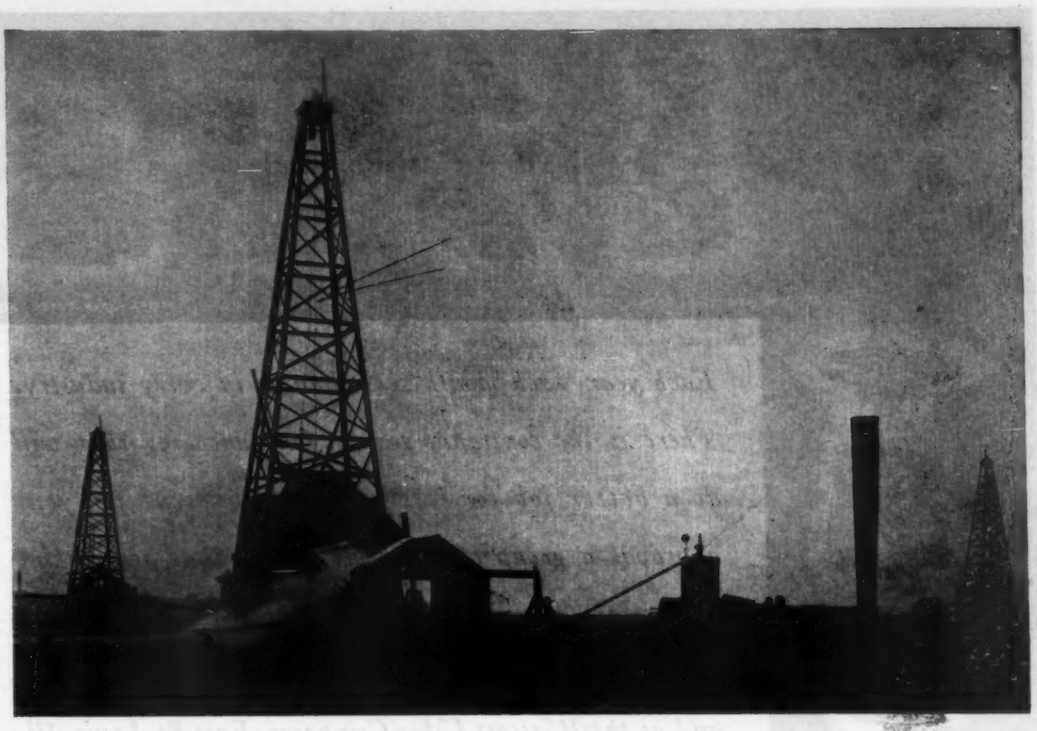
All of this work firmly established the practice of engineering in the production branch of the industry and had a direct bearing upon the future trend of the business.

Cost of Rigs

The following comparative figures on drilling equipment used in the various fields in this country in 1914 give as good an idea of material used as anything else that might be quoted:

74-foot derrick with 4½-inch rig irons used in Pennsylvania, West Virginia and Ohio	$525.00
74-foot derrick wi.h 4½-inch rig irons used in Oklahoma	950.00
82-foot derrick with 6-inch rig and calf irons in Oklahoma	1,250.00
84-foot derrick with 6-inch chain-driven rig and calf irons in North Texas	1,650.00
84-foot heavy derrick with 6-inch chain-driven rig and calf irons in California	1,750.00
106-foot heavy combination standard and rotary derrick, with 6-inch chain-driven rig and calf irons in California	1,975.00
114-foot heavy combination standard and rotary derrick with concrete corners, iron bull and calf wheel shafts and 6-inch chain-driven rig and calf irons, in California	2,250.00
82-foot derrick with 6-inch chain-driven rig and calf irons, in Wyoming	.....
84-foot Gulf Coast rotary derrick, wooden	360.00
112-foot Gulf Coast rotary derrick, wooden	400.00

The derricks referred to in the above specifications were made of wood.



Galbreath & Chessley No. 1 Ida Glenn, discovery well — Galbreath & Colcord, third well — Galbreath & Chessley, second well

Galbreath & Chessley's No. 1 Ida Glenn, located in C N half S half SE Section 10-17-12, in the southwestern part of Tulsa County, Oklahoma. This well opened the famous Glenn Pool. Other wells shown were drilled immediately after discovery well was completed

Simple Methods Followed

During the fourth period the production men followed rather simple methods in keeping the wells on production. It was the usual practice to shoot the hole to complete the well and this was followed by cleaning out the hole and the same methods were resorted to from time to time as the production rate fell off.

With the entry of the engineers into the production department many suggestions were offered for increasing production, but as new fields were still being opened as the older ones decreased in producing rate there was little incentive to invest money in methods to increase production.

However, the use of vacuum pulled on the sands was suggested but it was prohibited by state laws in some states. Likewise flooding by water was against the law and other statutes regulated the methods and means that might be used in securing oil and operating a property so the owners did not have much choice, particularly in Pennsylvania where there was the greatest incentive to apply restoration measures because of the age of the wells.

Many operators realized that there was much that could be done to improve production conditions and lengthen the life of wells but so long as new fields were being found at a rate that supplied the market with an excess of oil during most of the time the owners of wells did not feel that they were justified in spending much money on old wells. That the average life of wells during this period was a little over 15 years indicates that there were many things the operators had learned about production.

Miscellaneous

It is reported that George E. Burton in 1917 suggested the use of the diamond drill for exploring for oil and gas and in 1919 one of these outfits was used at Sawyer, Okla., and drilled a hole from 2,200 feet, where it had been finished by cable tools, to a total depth of 4,920 feet and gave very definite information of the formation penetrated to the operator.

OIL DISCOVERED—1904-1919

Year	Province—	State—	Field—	County—
1905	Appalachian	Pennsylvania	Volan.	Mercer
	Appalachian	Pennsylvania	Woodruff	Greene
	Appalachian	C. & S. E. Ohio	Bluck	Jefferson
	Appalachian	C. & S. E. Ohio	Woodsfield	Monroe
	Appalachian	West Virginia	Big Springs	Calhoun
	Appalachian	West Virginia	Spindletop	Pleasants
	Appalachian	West Virginia	Wolf Pen	Ritchie
	Appalachian	West Virginia	Craddock	Upshur
	Appalachian	Kentucky	Morgan County	Morgan
	Appalachian	Kentucky	Barrier	Wayne
	Appalachian	Kentucky	Dry Creek	Knott
	Appalachian	Kentucky	.....	Morgan
	Appalachian	Kentucky	Stinking Creek	Wayne
	Appalachian	Kentucky	Turkey Rock	Wayne
	Lima-Indiana	N. E. Indiana	Salamonie	Huntington
	Lima-Indiana	N. E. Indiana	Warren	Wells
	Ill.-S. W. Ind.	Illinois	North Johnson	Clark
	Ill.-S. W. Ind.	Illinois	South Johnson	Clark
	Ill.-S. W. Ind.	Illinois	Westfield	Clark
	Mid-Continent	Oklahoma	Glenn Pool	Creek
	Mid-Continent	No. Louisiana	Caddo	Caddo
	No. Texas	Texas	Chatfield	Navarro
	Gulf Coast	Texas	North Dayton	Liberty
	Rocky Mt.	Wyoming	Torchlight	Big Horn

(Continued on Next Page)

Each year, each month sees changes in every industry. There is the continual search for something that will do a better job for less cost. We present for your approval a group of Westcott Valves that are making history in the oil and gas industry. Full stocks are carried in the stores of The Continental Supply Company and at the Westcott Valve Company, East St. Louis, Ill.

SEMI-STEEL FLOW LINE VALVE

1500 LB. STEEL FLOW LINE VALVE

OS&Y STANDARD VALVE

1500 LB. SEMI-STEEL FLOW LINE VALVE

7" STEEL FLOW LINE VALVE SCREW END

7" STEEL FLOW LINE VALVE FLANGE END

WESTCOTT VALVES

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

Year	Province—	State—	Field—	County—
1906	Appalachian	Pennsylvania	Dague	Washington
	Appalachian	Pennsylvania	Mehaffey	Washington
	Appalachian	Pennsylvania	Miola	Clarion
	Appalachian	West Virginia	Congo	Hancock
	Appalachian	Kentucky	Bradley (Broadway)	Floyd
	Appalachian	Kentucky	Corder	McCreary
	Appalachian	Kentucky	Sulphur Creek	Cumberland
	Ill-S. W. Ind.	Illinois	Hardinsville	Crawford
	Ill-S. W. Ind.	Illinois	Kibbie	Crawford
	Ill-S. W. Ind.	Illinois	Oblong	Crawford
	Ill-S. W. Ind.	Illinois	Robinson	Crawford
	Ill-S. W. Ind.	Illinois	Bridgeport	Lawrence
	Mid-Continent	Oklahoma	Beland	Muskogee
	Mid-Continent	Oklahoma	Bird Creek	Tulsa
	Mid-Continent	Oklahoma	Dawson	Tulsa
	Mid-Continent	Oklahoma	Madill	Marshall
	Mid-Continent	Oklahoma	Morris	Okmulgee
	Mid-Continent	Oklahoma	Okmulgee (Lucky Pool)	Okmulgee
	Mid-Continent	Oklahoma	Oolagah	Rogers
	Mid-Continent	Oklahoma	Skiatook	Osage
	Mid-Continent	Kansas	Vilas	Neosho
	California	California	Lompoc	Santa Barbara
	California	California	Arroyo Grande	San Luis Obispo
	California	California	West Coyote	Orange
1907	Appalachian	Pennsylvania	Latrobe	Westmoreland
	Appalachian	West Virginia	Follansbee	Brooke
	Appalachian	West Virginia	Holliday's Cove	Brooke
	Appalachian	West Virginia	Griffithsville	Lincoln
	Appalachian	West Virginia	.....	Clay
	Appalachian	West Virginia	Queen Shoals	Clay
	Appalachian	West Virginia	Queen Shoals	Kanawha
	Appalachian	West Virginia	Logansport	Marion
	Appalachian	West Virginia	Miracle Run	Monongalia
	Appalachian	West Virginia	Walton (Rock Creek)	Roane
	Appalachian	Kentucky	Bratcher Hal	Wayne
	Ill.-S. W. Ind.	Illinois	Flat Rock	Crawford
	Ill.-S. W. Ind.	Illinois	Honey Creek	Crawford
	Ill.-S. W. Ind.	Illinois	Parker	Crawford
	Ill.-S. W. Ind.	Illinois	Siggins	Cumberland
	Ill.-S. W. Ind.	Illinois	Applegate-Nuttall	Lawrence
	Ill.-S. W. Ind.	Illinois	Lawrenceville	Lawrence
	Ill.-S. W. Ind.	S. W. Indiana	Oakland City	Pike
	Mid-Continent	Oklahoma	Canary	Washington
	Mid-Continent	Oklahoma	Coalton	Okmulgee
	Mid-Continent	Oklahoma	Copan	Washington
	Mid-Continent	Oklahoma	Cruce	Stephens
	Mid-Continent	Oklahoma	Hogshooter	Washington
	Mid-Continent	Oklahoma	Schulter (Henryetta)	Okmulgee
	Mid-Continent	Oklahoma	Wann	Nowata
	Mid-Continent	No. Texas	Avis	Jack
	Mid-Continent	No. Texas	Mission	Bexar
	Mid-Continent	Kansas	Hale	Chautauqua
	Gulf Coast	Texas	Piedras Pintas	Duval
	Gulf Coast	Louisiana	Vinton	Calcasieu
	Rocky Mt.	Wyoming	Byron	Big Horn
	Rocky Mt.	Wyoming	Greybull	Big Horn
	Rocky Mt.	Wyoming	La Barge	Lincoln-Sublette
	Rocky Mt.	Wyoming	Lamb	Big Horn
	Rocky Mt.	Utah	Virgin River	Washington
	California	California	Coyote Hills	Orange
1908	Appalachian	Pennsylvania	Pine Run	Westmoreland
	Appalachian	West Virginia	Buffalo Creek	Glover Gap
	Appalachian	West Virginia	French Creek	Pleasants
	Appalachian	West Virginia	Branchland	Lincoln
	Appalachian	West Virginia	Bonds Creek	Ritchie-Pleasants
	Appalachian	Kentucky	Johnson Fork	Wayne
	Appalachian	Kentucky	Monticello	Wayne
	Appalachian	Kentucky	Mount Pisgah	Wayne
	Ill.-S. W. Ind.	Illinois	Junction City	Marion
	Mid-Continent	Oklahoma	Bald Hill	Okmulgee
	Mid-Continent	Oklahoma	Delaware-Childers	Nowata
	Mid-Continent	Oklahoma	Gotebo	Kiowa
	Mid-Continent	Oklahoma	Independent	Okmulgee
	Mid-Continent	Oklahoma	Tiger Flats (Turkey Pen Hollow)	Okmulgee
	Gulf Coast	Texas	Markham	Matagorda
	Rocky Mt.	Wyoming	Salt Creek	Natrona
	Rocky Mt.	Colorado	Rangely	Rio Blanco
	Rocky Mt.	Utah	San Juan	San Juan
	California	California	Beverly Hills	Los Angeles
	California	California	Cat Canyon	Santa Barbara
1909	Appalachian	Pennsylvania	Sigel	Jefferson
	Appalachian	West Virginia	Fowlersville	Brooke
	Appalachian	West Virginia	Bomont	Clay
	Appalachian	West Virginia	Mount Claire	Harrison
	Appalachian	West Virginia	Shinnston	Harrison
	Appalachian	West Virginia	Falling Rock Creek	Kanawha
	Appalachian	West Virginia	Rush Run (Clover)	Roane
	Appalachian	West Virginia	Tariff (Bright)	Roane
	Appalachian	West Virginia	Frenchton	Upshur
	Appalachian	West Virginia	Dunlow	Wayne
	Appalachian	Kentucky	Rock Branch	Wayne
	Appalachian	Kentucky	Stillwater	Wolfe
	Lima-Indiana	N. E. Indiana	Boone Twp.	Cass
	Ill.-S. W. Ind.	Illinois	New Hebron	Crawford
	Ill.-S. W. Ind.	Illinois	York	Cumberland
	Ill.-S. W. Ind.	Illinois	Greenville (Lindley)	Bond
	Ill.-S. W. Ind.	Illinois	Carlinville	Macoupin
	Ill.-S. W. Ind.	Illinois	Collinsville	Madison
	Ill.-S. W. Ind.	Illinois	Sandoval	Marion
	Mid-Continent	Oklahoma	Ada	Pontotoc
	Mid-Continent	Oklahoma	Caney	Washington
	Mid-Continent	Oklahoma	Coody	Muskogee
	Mid-Continent	Oklahoma	Elliot	Nowata
	Mid-Continent	Oklahoma	Hamilton Switch	Okmulgee
	Mid-Continent	Oklahoma	Haskell	Nowata
	Mid-Continent	Oklahoma	Nowata-Claggett	Nowata
	Mid-Continent	Oklahoma	Preston	Okmulgee
	Mid-Continent	Oklahoma	Sapulpa	Creek
	Mid-Continent	Oklahoma	Sperry	Tulsa
	Mid-Continent	No. Texas	Reiser	Webb
	Rocky Mt.	Wyoming	Plunkett	Fremont
	Rocky Mt.	New Mexico	Dayton	Eddy
1910	Appalachian	Pennsylvania	Bessemer	Lawrence
	Appalachian	Pennsylvania	Callery	Butler
	Appalachian	Pennsylvania	Suterville	Westmoreland
	Appalachian	Pennsylvania	White Ash	Allegheny
	Appalachian	West Virginia	Big Creek-Chapmansville	Logan
	Appalachian	Kentucky	Beach Grove	McLean
	Appalachian	Kentucky	Central City	Muhlenberg
	Appalachian	Kentucky	Diamond Springs	Logan
	Appalachian	Kentucky	Gibson	Wayne
	Appalachian	Kentucky	Paxton	Wayne
	Ill.-S. W. Ind.	Illinois	Bellair	Crawford
	Ill.-S. W. Ind.	Illinois	Centralia	Marion
	Ill.-S. W. Ind.	Illinois	Duncanville	Crawford
	Mid-Continent	Oklahoma	Beggs	Okmulgee
	Mid-Continent	Oklahoma	Henryetta	Okmulgee
	Mid-Continent	Oklahoma	Kiefer	Creek
	Mid-Continent	Oklahoma	Ochelata	Washington
	Mid-Continent	Oklahoma	Poteau	LeFlore
	Mid-Continent	Oklahoma	Red Oak	Latimer
	Mid-Continent	Oklahoma	Salt Creek (Gypsum Hill)	Okmulgee
	Mid-Continent	Oklahoma	Sequoyah	Sequoyah
	Mid-Continent	Oklahoma	Timber Ridge	Muskogee
	Mid-Continent	Oklahoma	Vinita	Rogers-Craig
	Mid-Continent	Oklahoma	Wainright	Muskogee
	Mid-Continent	No. Texas	Somerset	Bexar
	Mid-Continent	No. Texas	Gas Ridge	Bexar
	California	California	Lost Hills	Kern
1911	Appalachian	Pennsylvania	Wooster	Wayne
	Appalachian	West Virginia	Bomont	Clay
	Appalachian	West Virginia	.....	Kanawha
	Appalachian	West Virginia	Blue Creek	Kanawha
	Appalachian	West Virginia	Weir	Kanawha
	Appalachian	West Virginia	Bellville	Wood
	Appalachian	West Virginia	Maidsville	Monongalia
	Appalachian	West Virginia	Hogans	Monongalia
	Appalachian	West Virginia	Warwood (Glenns Run)	Ohio
	Ill.-S. W. Ind.	Illinois	Carlyle	Clinton
	Ill.-S. W. Ind.	Illinois	Brown	Marion
	Ill.-S. W. Ind.	Illinois	Langewisch-Keuster	Marion
	Ill.-S. W. Ind.	S. W. Indiana	Laconia	Harrison
	Ill.-S. W. Ind.	S. W. Indiana	Edwards	Sullivan
	Mid-Continent	Oklahoma	Adair	Nowata
	Mid-Continent	Oklahoma	California Creek	Nowata
	Mid-Continent	Oklahoma	Dilworth	Kay
	Mid-Continent	Oklahoma	Glenoak	Nowata
	Mid-Continent	Oklahoma	Osage City	Osage
	Mid-Continent	Oklahoma	Ramona	Washington
	Mid-Continent	No. Texas	Burkburnett	Wichita
	Mid-Continent	No. Texas	Electra	Wichita
	Mid-Continent	No. Texas	Miller	Archer
	Mid-Continent	No. Texas	Trickham	Coleman
	Rocky Mt.	New Mexico	Seven Lakes	McKinley
	California	California	Shiells Canyon	Ventura
	California	California	Belridge	Kern
1912	Appalachian	Pennsylvania	Sligo	Clarion
	Appalachian	C. & S. E. Ohio	Cleveland	Cuyahoga
	Appalachian	West Virginia	.....	Boone
	Appalachian	West Virginia	Racine	Boone
	Appalachian	Kentucky	Cannel City	Morgan
	Appalachian	Kentucky	Hartford	Ohio
	Appalachian	Kentucky	Petroleum	Allen
	Appalachian	Kentucky	Rodemer	Allen
	Ill.-S. W. Ind.	Illinois	Allendale	Wabash
	Ill.-S. W. Ind.	S. W. Indiana	Cannelburg	Daviess
	Mid-Continent	Oklahoma	Boston	Osage
	Mid-Continent	Oklahoma	Coal	Coal
	Mid-Continent	Oklahoma	Cushing	Payne
	Mid-Continent	Oklahoma	Drumright	Creek
	Mid-Continent	Oklahoma	French	Okmulgee
	Mid-Continent	Oklahoma	Onapa	McIntosh
	Mid-Continent	Oklahoma	Terlton	Pawnee
	Mid-Continent	Oklahoma	Wewoka	Seminole
	Mid-Continent	Oklahoma	Wildhorse	Osage
	Mid-Continent	No. Louisiana	Pelican	DeSoto-Sabine
	Gulf Coast	Louisiana	Pine Prairie	Evangeline
	Gulf Coast	Louisiana	Edgerly	Calcasieu
	Rocky Mt.	Wyoming	Oregon Basin	Park
1913	Appalachian	West Virginia	Madison	Boone
	Appalachian	West Virginia	Hackberry	Kanawha
	Ill.-S. W. Ind.	Illinois	Jackson	Crawford
	Ill.-S. W. Ind.	Illinois	Dennison Twp.	Lawrence
	Ill.-S. W. Ind.	Illinois	Herbert	Lawrence
	Ill.-S. W. Ind.	S. W. Indiana	Heims	Sullivan
	Ill.-S. W. Ind.	S. W. Indiana	Jacobs	Daviess
	Ill.-S. W. Ind.	S. W. Indiana	Scott	Sullivan
	Mid-Continent	Oklahoma	Allen	Pontotoc
	Mid-Continent	Oklahoma	Asphaltum	Jefferson
	Mid-Continent	Oklahoma	Catoosa	Rogers
	Mid-Continent	Oklahoma	Healdton	Carter
	Mid-Continent	Oklahoma	Inola	Rogers
	Mid-Continent	Oklahoma	Loco	Stephens
	Mid-Continent	Oklahoma	Mervine	Kay
	Mid-Continent	Oklahoma	Owasso	Tulsa
	Mid-Continent	Oklahoma	Pond Creek	Osage
	Mid-Continent	Oklahoma	Quinton	Pittsburg
	Mid-Continent	Oklahoma	Slick	Creek
	Mid-Continent	Oklahoma	Stigler (Kinta)	Haskell
	Mid-Continent	Oklahoma	Talala	Rogers
	Mid-Continent	Oklahoma	Weleetka	Okfuskee
	Mid-Continent	No. Texas	Moran	Shackelford
	Mid-Continent	No. Texas	Toyah	Reeves
	Mid-Continent	No. Louisiana	Red River-Bull Bayou	De Soto
	Mid-Continent	No. Louisiana	Naborton	De Soto
	Gulf Coast	Texas	Orange	Orange
	Rocky Mt.	Montana	Glendive	Dawson
	Rocky Mt.	Colorado	DeBeque	Mesa
1914	Appalachian	C & S. E. Ohio	Berea	Cuyahoga
	Appalachian	West Virginia	Cabin Creek	Kanawha
	Ill.-S. W. Ind.	Illinois	McClintock	Cumberland
	Ill.-S. W. Ind.	Illinois	Murphy	Lawrence
	Ill.-S. W. Ind.	Illinois	St. Francisville	Lawrence
	Ill.-S. W. Ind.	Illinois	Colmar-Plymouth	McDonough-Hancock
	Ill.-S. W. Ind.	S. W. Indiana	Denny	Sullivan
	Ill.-S. W. Ind.	S. W. Indiana	Harmon	Sullivan
	Ill.-S. W. Ind.	S. W. Indiana	Sullivan	Sullivan
	Mid-Continent	Oklahoma	Bixby	Tulsa
	Mid-Continent	Oklahoma	Blackwell	Kay
	Mid-Continent	Oklahoma	Boynton	Muskogee
	Mid-Continent	Oklahoma	Cameron	LeFlore
	Mid-Continent	Oklahoma	Cement	Caddo
	Mid-Continent	Oklahoma	Cole	Muskogee
	Mid-Continent	Oklahoma	Coweta	Wagoner
	Mid-Continent	Oklahoma	Hanna	McIntosh
	Mid-Continent	Oklahoma	Hickory Creek	Osage
	Mid-Continent	Oklahoma	Ingalls	Payne
	Mid-Continent	Oklahoma	Kusa	McIntosh
	Mid-Continent	Oklahoma	Landon	Osage
	Mid-Continent	Oklahoma	Mission	Wagoner
	Mid-Continent	Oklahoma	Nazura	Okmulgee
	Mid-Continent	Oklahoma	Oilton	Creek
	Mid-Continent	Oklahoma	Olive	Creek
	Mid-Continent	Oklahoma	Paden	Okfuskee
	Mid-Continent	Oklahoma	Pemeta	Creek
	Mid-Continent	Oklahoma	Prairie	Creek
	Mid-Continent	Oklahoma	Quapaw	Osage
	Mid-Continent	Oklahoma	Quay	Pawnee
	Mid-Continent	Oklahoma	Ripley	Payne
	Mid-Continent	Oklahoma	Shamrock	Creek
	Mid-Continent	Oklahoma	Spiro	LeFlore
	Mid-Continent	Oklahoma	Stidham	McIntosh
	Mid-Continent	Oklahoma	Summers	Muskogee
	Mid-Continent	Oklahoma	Turley	Tulsa
	Mid-Continent	Oklahoma	Wagoner	Wagoner
	Mid-Continent	Oklahoma	Wildcat Jim	Carter
	Mid-Continent	Oklahoma	Wimer	Craig
	Mid-Continent	Oklahoma	Yahola	Muskogee
	Mid-Continent	Oklahoma	Yale	Payne
	Mid-Continent	No. Texas	Powlkes	Wichita
	Mid-Continent	No. Texas	Iowa Park	Wichita
	Mid-Continent	No. Texas	Jennings	Zapata

(Continued on Next Page)

Making *Tomorrow's* History *Today!*

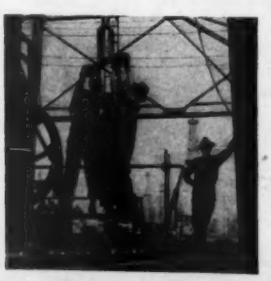
AN INSTANT success only 12 months ago, Gun Perforator Service has brought satisfaction to more than 124 different companies in hundreds of wells, under conditions previously considered impossible.

Completely self-contained truck units are ready for service day or night, rain or shine.

PERFORATING 7 days each week — often several wells during 24 hours — efficient service trucks have been making tomorrow's history. Larger and faster units are today proving our slogan: "If the Oil is There, We Get It" — at a cost so low that it is often repaid by one day's extra production.

MID-CONTINENT AND FOREIGN

Gun Perforator Service is now available on the Gulf Coast — see below. Arrangements are being perfected to cover the entire Mid-Continent and major foreign fields. We invite your detailed inquiries.



Lowering Lane-Wells Gun Perforator into the well.

Rear view of truck showing Guns in upper compartments and individual loads in trays below. Note complete, compact equipment.

The "shooter's seat" showing depth measurement gauges, operating controls and instruments to prove actual detonation of charge in the well.

The Lane-Wells Magnet Fishing Service — another of "Tomorrow's Tools — Today!"

Gun Perforation consists of electrical detonation of powder to propel a steel bullet through one or more strings of casing, with cement filling both the annular spaces between the strings and the space back of the casing. Clean perforations are spaced as desired, at any specified depth, without distorting the casing. Gun Perforator Service comes to your well on a completely self - contained truck unit. You supply nothing except ordinary pulling equipment usually on every well.

Ready for a test shot through 6⅝" 26-lb., 8⅝" 36-lb. and 10¾" 45-lb. casing.

Result of test shot described above. Similar perforations are obtained with cement between casing.

CALIFORNIA SERVICE

Additional and larger equipment is today available to give you prompt, dependable service in all fields. Our telephone number is JEfferson 5289.

GUN PERFORATOR SERVICE

On the Pacific Coast
THE LANE - WELLS CO.
4439 Santa Fe Avenue
Los Angeles, California

Fully protected by Patent No. 1,582,184, and other patents pending.

On the Gulf Coast
TEXAS IRON WORKS SALES CORP.
1401 Maury Street
Houston, Texas

Year	Province—	State—	Field—	County—
	Mid-Continent	Kansas	South Augusta	Butler
	Mid-Continent	Kansas	North Augusta	Butler
	Mid-Continent	Kansas	Winfield (Peacock)	Cowley
	Mid-Continent	No. Louisiana	Crichton	Red River
	Gulf Coast	Texas	White Point	San Patricio
	Rocky Mt.	Wyoming	Buffalo Basin	Park-Hot Springs
1915	Appalachian	Pennsylvania	Mifflin	Allegheny
	Appalachian	Pennsylvania	Warsaw	Jefferson
	Appalachian	West Virginia	.....	Barbour
	Appalachian	West Virginia	Benson	Barbour
	Appalachian	West Virginia	Joes Creek	Boone
	Appalachian	West Virginia	Burnsville	Braxton
	Ill.-S. W. Ind.	Illinois	Kansas	Edgar
	Ill.-S. W. Ind.	Illinois	Spanish Needle Creek	Macoupin
	Ill.-S. W. Ind.	Illinois	Staunton	Macoupin
	Ill.-S. W. Ind.	Illinois	Gillespie (Wyen)	Macoupin
	Ill.-S. W. Indiana	S. W. Indiana	Washington Twp.	Pike
	Mid-Continent	Oklahoma	Brinton (Brookins)	Okmulgee
	Mid-Continent	Oklahoma	Billings	Noble
	Mid-Continent	Oklahoma	Depew	Creek
	Mid-Continent	Oklahoma	Eufala	McIntosh
	Mid-Continent	Oklahoma	Fox	Carter
	Mid-Continent	Oklahoma	Kelleyville	Creek
	Mid-Continent	Oklahoma	Lauderdale	Pawnee
	Mid-Continent	Oklahoma	Mounds	Creek
	Mid-Continent	Oklahoma	New York	Creek
	Mid-Continent	Oklahoma	Porter	Wagoner
	Mid-Continent	Oklahoma	Redbird	Wagoner
	Mid-Continent	Oklahoma	South Coffeyville	Nowata
	Mid-Continent	Oklahoma	South Elgin (Buck Cr.)	Osage
	Mid-Continent	Oklahoma	Stone Bluff	Wagoner
	Mid-Continent	Oklahoma	Vera	Washington
	Mid-Continent	Oklahoma	Vines (Scott)	Murray
	Mid-Continent	Oklahoma	Wicey	Tulsa
	Mid-Continent	Oklahoma	Youngstown	Okmulgee
	Mid-Continent	North Texas	Brenham	Washington
	Mid-Continent	North Texas	South Medina	Bexar
	Mid-Continent	North Texas	Alta Vista	Bexar
	Mid-Continent	North Texas	Strawn	Palo Pinto
	Mid-Continent	North Texas	Angus, Edens, Hodge	Navarro
	Mid-Continent	North Texas	Thrall	Williamstown
	Mid-Continent	North Texas	Witherspoon-McKie	Navarro
	Mid-Continent	North Texas	Burke	Navarro
	Mid-Continent	Arkansas	Kibler	Crawford
	Gulf Coast	Louisiana	Bayou Boullion	St. Martin
	Rocky Mt.	Wyoming	Big Muddy	Converse
	Rocky Mt.	Wyoming	Elk Basin	Park
	Rocky Mt.	Wyoming	Upton-Thornton	Weston
	Rocky Mt.	Montana	Baker	Fallon
	Rocky Mt.	Montana	Elk Basin	Carbon
	Rocky Mt.	Montana	Havre	Hill
	California	California	Kern Front	Kern
	California	California	Ventura Avenue	Ventura
1916	Appalachian	West Virginia	Baldwin	Gilmer
	Appalachian	West Virginia	Dents Run)	Marion
	Appalachian	Kentucky	Big Hill	Madison
	Appalachian	Kentucky	Bolyn	Knott
	Appalachian	Kentucky	Fisher	Allen
	Appalachian	Kentucky	Gainesville	Allen
	Appalachian	Kentucky	Hiserville	Barren
	Appalachian	Kentucky	Hodten	Allen
	Appalachian	Kentucky	Miller	Allen
	Appalachian	Tennessee	Glenmary	Scot
	Ill.-S. W. Ind.	Illinois	Billet	Lawrence
	Ill.-S. W. Ind.	S. W. Indiana	Hoover	Gibson
	Ill.-S. W. Ind.	S. W. Indiana	McDonald	Gibson
	Ill.-S. W. Ind.	S. W. Indiana	Mount Olympus	Gibson
	Mid-Continent	Oklahoma	Barnsdall	Osage
	Mid-Continent	Oklahoma	Bartlett	McIntosh
	Mid-Continent	Oklahoma	Bristow	Creek
	Mid-Continent	Oklahoma	Broken Arrow	Tulsa
	Mid-Continent	Oklahoma	Brushy Mountain	Muskogee
	Mid-Continent	Oklahoma	Collinsville	Tulsa
	Mid-Continent	Oklahoma	Council Hill	Muskogee
	Mid-Continent	Oklahoma	Enos (Lark)	Marshall
	Mid-Continent	Oklahoma	Francis	Pontotoc
	Mid-Continent	Oklahoma	Garber	Garfield
	Mid-Continent	Oklahoma	Holdenville	Hughes
	Mid-Continent	Oklahoma	Homer	Carter
	Mid-Continent	Oklahoma	Jennings	Pawnee-Creek
	Mid-Continent	Oklahoma	Knox	Stephens
	Mid-Continent	Oklahoma	Leonard	Tulsa
	Mid-Continent	Oklahoma	Major	Okmulgee
	Mid-Continent	Oklahoma	Milroy	Stephens
	Mid-Continent	Oklahoma	Myers Dome	Osage
	Mid-Continent	Oklahoma	Newkirk	Kay
	Mid-Continent	Oklahoma	Oneta	Wagoner
	Mid-Continent	Oklahoma	Peterson	Muskogee
	Mid-Continent	Oklahoma	Ralston	Pawnee
	Mid-Continent	Oklahoma	Sand Springs	Tulsa
	Mid-Continent	North Texas	Panther	Archer
	Mid-Continent	North Texas	Rice-Oil Ridge	Navarro
	Mid-Continent	North Texas	Roxana-Williams	Jack
	Mid-Continent	Kansas	El Dorado	Butler
	Mid-Continent	Kansas	Towanda	Butler
	Mid-Continent	No. Louisiana	Elm Grove	Bossier
	Rocky Mt.	Wyoming	Hudson (Lander)	Fremont
	Rocky Mt.	Wyoming	Lost Soldier	Sweetwater
	Rocky Mt.	Wyoming	Pilot Butte	Fremont
	Rocky Mt.	Wyoming	Pole Cat	Park
	Rocky Mt.	Wyoming	Powder River	Natrona
	California	California	South Mountain	Ventura
1917	Appalachian	Pennsylvania	Clugston	Allegheny
	Appalachian	Pennsylvania	Gaines	Tioga
	Appalachian	Pennsylvania	Hookstorm	Beaver
	Appalachian	Pennsylvania	Knoxville	Tioga
	Appalachian	Pennsylvania	Monaca	Beaver
	Appalachian	Pennsylvania	New Bethlehem	Clarion
	Appalachian	West Virginia	Little Gap	Gilmer
	Appalachian	West Virginia	Kellys Creek (Ward)	Kanawha
	Appalachian	West Virginia	Breeden	Mingo
	Appalachian	West Virginia	Stover Fork of Sycamore	Raleigh
	Appalachian	West Virginia	Pruntytown	Taylor
	Appalachian	Kentucky	Adolphus	Allen
	Appalachian	Kentucky	Ashley	Powell
	Appalachian	Kentucky	Brush Creek	Lincoln
	Appalachian	Kentucky	Bull Creek	Floyd
	Appalachian	Kentucky	Emberton	Monroe
	Appalachian	Kentucky	Flat Gap	Johnson
	Appalachian	Kentucky	Caddie	Metcalfe
	Appalachian	Kentucky	Green River	Greene
	Appalachian	Kentucky	Holly Creek	Wolfe
	Appalachian	Kentucky	Jackson	Warren
	Appalachian	Kentucky	Lanhart	Jackson
	Appalachian	Kentucky	Meredith	Grayson
	Appalachian	Kentucky	Newcombe Creek	Elliott
	Appalachian	Kentucky	Olympia Creek	Bath
	Appalachian	Kentucky	Paint Creek	Johnson
	Appalachian	Kentucky	Tobey	Metcalfe
	Appalachian	Kentucky	Williams	Warren
	Ill.-S. W. Ind.	Illinois	Warrenton-Bartum Area	Edgar
	Ill.-S. W. Ind.	Illinois	Ayers	Bond
	Ill.-S. W. Ind.	S. W. Indiana	Gladdish	Pike
	Ill.-S. W. Ind.	S. W. Indiana	Bragdon	Sullivan
	Mid-Continent	Oklahoma	Alabama	Hughes
	Mid-Continent	Oklahoma	Covington	Garfield
	Mid-Continent	Oklahoma	Domes	Osage
	Mid-Continent	Oklahoma	Graham	Carter
	Mid-Continent	Oklahoma	Hoffman	Okmulgee
	Mid-Continent	Oklahoma	Iron Post	Creek
	Mid-Continent	Oklahoma	Morrison (Watchorn)	Pawnee
	Mid-Continent	Oklahoma	Okfuskee	Okfuskee
	Mid-Continent	Oklahoma	Pershing	Osage
	Mid-Continent	Oklahoma	Ponca City	Kay
	Mid-Continent	Oklahoma	Nelagoney	Osage
	Mid-Continent	Oklahoma	Sheetz	Creek
	Mid-Continent	Oklahoma	Sheppard	Muskogee
	Mid-Continent	Oklahoma	Spencer	Okmulgee
	Mid-Continent	Oklahoma	Striker	Wagoner
	Mid-Continent	Oklahoma	Tanecha	Tulsa
	Mid-Continent	Oklahoma	Velma	Stephens
	Mid-Continent	Oklahoma	Walters	Cotton
	Mid-Continent	Oklahoma	Webster	Wagoner
	Mid-Continent	Oklahoma	Wynona	Osage
	Mid-Continent	North Texas	Bethany	Panola
	Mid-Continent	North Texas	Breckenridge	Stephens
	Mid-Continent	North Texas	Ranger	Eastland
	Mid-Continent	North Texas	Shelbyville	Shelby
	Mid-Continent	North Texas	Tilton-Havener	Navarro
	Mid-Continent	Kansas	Douglas	Butler
	Mid-Continent	Kansas	Fox-Bush	Butler
	Mid-Continent	Kansas	Guilford Twp.	Wilson
	Mid-Continent	Kansas	Mound Valley	Labette
	Mid-Continent	Kansas	Walnut-Helper	Bourbon-Crawford
	Mid-Continent	Kansas	Wilson-Dunkle	Butler
	Mid-Continent	No. Louisiana	Pine Island	Caddo
	Gulf Coast	Texas	Goose Creek	Harris
	Gulf Coast	Louisiana	New Iberia	Iberia
	Rocky Mt.	Wyoming	Boone Dome	Natrona
	Rocky Mt.	Wyoming	Pine Mountain	Natrona
	Rocky Mt.	Wyoming	Warm Springs	Hot Springs
	Rocky Mt.	Wyoming	Winkleman	Fremont
	Rocky Mt.	Montana	Cabin Creek	Fallon
	California	California	Casmalia	Santa Barbara
	California	California	Montebello	Los Angeles

(Continued on Next Page)

History repeats itself every year!

SEVEN years ago Tube-Turns were the world's first and largest-selling fittings for pipe-welding.

That same statement is as true today as it was then.

Success has fostered imitations, of course. It always does. But Tube-Turns can't be duplicated.

Hence Tube-Turns are—and doubtless will continue to be—the choice of those who want the best.

Why don't you cut up a few samples and see the difference?

TUBE-TURNS

FIRST in welding fittings

REVERSIBLE

WILLIAMS' "VULCAN BOLL-WEEVIL" is a REVERSIBLE tong. Change from "making-up" to "breaking-out" (or vice-versa) without even unhooking the chain. Merely engage rear, or forward teeth and operate handle in the desired direction.

You don't have to hold up the "Boll-Weevil" to apply it, either. It is laid on top of the pipe and the chain is then hooked around. Here's a tool that's easy to use and is simple in construction—only six parts. The "I Beam" handle provides extreme strength.

Every chain is proof-tested and CERTIFIED. Replacement chains are interchangeable, size for size, with chains for the other three patterns of Williams' "Vulcan" tongs.

Four sizes handle pipe ¾ to 12 inches; buy from your distributor.

J. H. WILLIAMS & CO.
"The Drop-Forging People"
75 Spring Street, New York
Western Warehouse and Sales Office: Chicago
Works, Buffalo, N. Y.

WILLIAMS
VULCAN
BOLL-WEEVIL
REVERSIBLE TONGS

PIPE LINES *of* PROGRESS

THE OLD WAY
A section of pipe line is shown being laid 25 years ago in the gas fields of southern West Virginia.

. . . *and* THE NEW
In striking contrast is this modern method of laying natural gas pipe lines for long distance transmission.

COLUMBIA SYSTEM

IN PAYING TRIBUTE to the diamond jubilee of the nation's petroleum industry, Columbia System recalls its own humble origin, more than a generation ago, at the hands of a courageous group of oil pioneers. In 1905 an undeveloped tract of 65,780 acres in southern West Virginia had been leased by these men for a project then popularly termed a "wild cat" oil scheme. Their holdings, however, were destined to become the foundation of Columbia's present vast natural gas reserves which today meet the fuel needs of nearly a million homes, industries and commercial consumers.

☆

It is worthy of note that at present nearly three-fourths of all the gas consumed in this country is derived from natural sources. Large expenditures for engineering skill and distributing facilities make possible its use in thousands of manufacturing processes where long its value went unrecognized.

☆

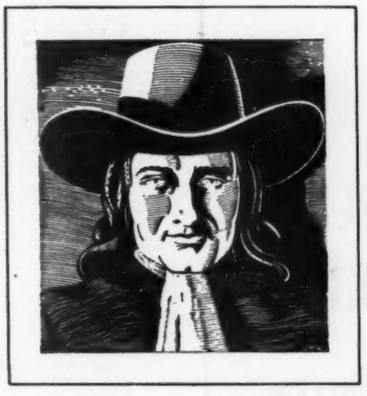
The contribution of Columbia System to progress in the gas industry has been significant—rivaling in many respects its achievements in the field of electric service. Last year its network of interconnecting pipe lines transported nearly a hundred billion cubic feet of the "perfect fuel" to customers, comprising a broad, widely diversified market in eight contiguous states.

☆

COLUMBIA GAS & ELECTRIC
61 Broadway CORPORATION New York

Making OIL HISTORY

WORLD wide reputation for a quality product is not attained in a day. Behind that product is the patient building of pioneers. Step by step, knowledge and experience were gained . . . priceless assets to the business of today.



The foundation stones of the Quaker State Corporation are buried deep in the history of oil. Let us consider these briefly:

50 YEARS AGO Enterprise Oil Company of Buffalo, N. Y., was born. It is one of the oldest companies in the industry and is celebrating its Golden Anniversary this year. In addition to Duplex Marine Oils, and other products, here are produced the Quaker State Superfine Lubricants . . . companion products of Quaker State Motor Oils.

40 YEARS AGO James B. Berry Sons' Company, Inc., Oil City, Pa., was founded. Now internationally known for reliability, service and integrity . . . specializing in complete petroleum products service to jobbers and wholesalers.

36 YEARS AGO Sterling Oil Company, Emlenton, Pa., was formed. Ever alert to progress in the industry, this division has the unique distinction of owning Permit No. 1 in the Pennsylvania Grade Crude Oil Association.

20 YEARS AGO Development of a new motor oil, Quaker State. Not content with even the best motor oil made in those days, our pioneering chemists delved further into the secrets of the crude, into the requirements of engines. A way was found to remove the quart or more of non-viscous oil which ordinary refining methods left in every gallon of ordinary motor oil. This quart of waste was replaced with rich, pure lubricant, thus giving the motorist "an extra quart of lubrication in every gallon of Quaker State." The results in the motor, of better lubrication, greater mileage, reduced repair expense, were so revolutionary that Quaker State Motor Oil quickly established a position of supreme Quality. This position of leadership is maintained to this day.

TODAY: Several years ago all of these organizations, deeply experienced in the oil industry, combined their assets. In addition to those previously mentioned was the Independent Refining Company at Oil City, which up to that time was the oldest refinery operating under its original name: also the Ohio Valley Refining Company.

Thus, today the Quaker State Oil Refining Corporation is old in experience yet modern as today in methods. Just as the Quaker of history is noted for his solid virtues, so the motor oil and lubricants of the Quaker State brand are supreme in Quality.

Yes, Quaker State has helped to make oil history! We salute the producers, refiners, marketers, and retailers who are joining to do homage to the driller of the *first* oil well . . . Col. Drake!

QUAKER STATE OIL REFINING CORPORATION

OIL CITY, PENNSYLVANIA, U. S. A.

Quaker State Oil Refining Company James B. Berry Sons' Company, Inc. Sterling Oil Company

Enterprise Oil Company Ohio Valley Refining Company

"The Engine of Constant Service"

Buffalo

DRILLING ENGINES

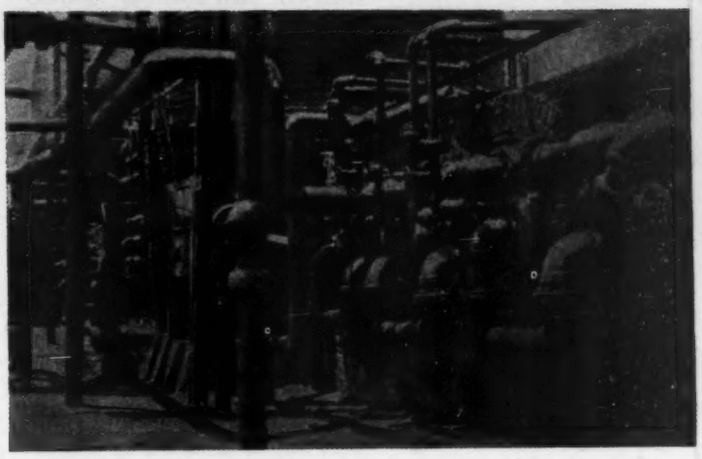
ABREAST OF SOUND AND PROVEN ENGINEERING PRACTICE AND DESIGN WITH

Larger crankshafts
Inserted alloy valve seats
Increased water circulation around valves
Large cleanout plates in cylinders and heads
Hyatt roller and ball bearings throughout clutch, gears, and pulley shaft bearings
Hardened clutch gears
Herringbone quiet reduction gears
Increased exhaust outlets
Full pressure lubrication system
Lubricating oil filter with bronze cleanable element
Combination gas and gasoline operation
Increased clutch area
Neutral brake
Cast Steel Frame.

BUFFALO GASOLENE MOTOR CO.
1280-1290 NIAGARA ST., BUFFALO, N. Y.

Year	Province—	State—	Field—	County—
1918	Appalachian	West Virginia	Cox Mills	Gilmer
	Appalachian	West Virginia	Revere	Gilmer
	Appalachian	West Virginia	Little Licking Creek	Wetzel
	Appalachian	Kentucky	Big Stinking	Lee
	Appalachian	Kentucky	Denton	Carter
	Appalachian	Kentucky	Duke	Allen
	Appalachian	Kentucky	Frozen Creek	Breathitt
	Appalachian	Kentucky	Colt	Warren
	Appalachian	Kentucky	Green River	Lincoln
	Appalachian	Kentucky	Hunt	Allen
	Appalachian	Kentucky	Lineman	Lee
	Appalachian	Kentucky	Little Frozen	Breathitt
	Appalachian	Kentucky	Maribe	Menefee
	Appalachian	Kentucky	Mendor	Allen
	Appalachian	Kentucky	Prestonburg	Floyd
	Appalachian	Kentucky	Redbush	Lawrence
	Appalachian	Kentucky	Red River	Powell
	Appalachian	Kentucky	Sam Martin	Warren
	Appalachian	Kentucky	Scottsville	Allen
	Appalachian	Kentucky	Short Creek	Grayson
	Appalachian	Kentucky	Sledge	Allen
	Appalachian	Kentucky	Stanton	Powell
	Appalachian	Kentucky	Travellers Rest	Owsley
	Appalachian	Kentucky	Wenn	Johnson
	Ill.-S. W. Ind.	S. W. Indiana	East Petersburg	Pike
	Mid-Continent	Oklahoma	Almeda	Osage
	Mid-Continent	Oklahoma	Barnes	Garfield
	Mid-Continent	Oklahoma	Butler	Muskogee
	Mid-Continent	Oklahoma	Comanche	Stephens
	Mid-Continent	Oklahoma	Dustin	Hughes
	Mid-Continent	Oklahoma	Fisher	Tulsa
	Mid-Continent	Oklahoma	Hector	Okmulgee
	Mid-Continent	Oklahoma	Magnolia	Stephens
	Mid-Continent	Oklahoma	Red Bank	Creek
	Mid-Continent	Oklahoma	Sageeyah	Rogers
	Mid-Continent	Oklahoma	Transcontinental	Muskogee
	Mid-Continent	No. Texas	Amarillo	Potter
	Mid-Continent	No. Texas	Binney	Stephens
	Mid-Continent	No. Texas	Brownwood	Brown
	Mid-Continent	No. Texas	Caddo	Stephens
	Mid-Continent	No. Texas	La Casa	Stephens
	Mid-Continent	No. Texas	Magnolia-Morris	Coleman
	Mid-Continent	No. Texas	Mitchell	Coleman
	Mid-Continent	Kansas	Dexter	Cowley
	Mid-Continent	Kansas	Elk City	Montgomery-Elk.
	Mid-Continent	Kansas	Mapleton	Bourbon
	Mid-Continent	Arkansas	Williams	Crawford
	Gulf Coast	Texas	Barbers Hill	Chambers
	Gulf Coast	Texas	Hull	Liberty
	Rocky Mt.	Wyoming	Allen Lake	Carbon
	Rocky Mt.	Wyoming	Big Sand Draw	Fremont
	Rocky Mt.	Wyoming	Dry Pinney	Sublette
	Rocky Mt.	Wyoming	Ferris	Carbon
	Rocky Mt.	Wyoming	Hamilton Dome	Hot Springs
	Rocky Mt.	Wyoming	Hidden Dome	Washakie
	Rocky Mt.	Wyoming	Lance Creek	Niobrara
	Rocky Mt.	Wyoming	Little Grass Creek	Hot Springs
	Rocky Mt.	Wyoming	Maverick Springs	Fremont
	Rocky Mt.	Wyoming	Rock Creek	Carbon
	Rocky Mt.	Wyoming	Sage Creek	Fremont
	Rocky Mt.	Colorado	White River	Rio Blanco
1919	Appalachian	Pennsylvania	Bellsano	Cambria
	Appalachian	Pennsylvania	Lincoln	Allegheny
	Appalachian	Pennsylvania	McKeesport	Allegheny
	Appalachian	Kentucky	Beech Bottom	Clinton
	Appalachian	Kentucky	Davenport	Warren
	Appalachian	Kentucky	Flat Rock	Simpson
	Appalachian	Kentucky	Hawesville	Hancock
	Appalachian	Kentucky	Ivyton	Magoffin
	Appalachian	Kentucky	Johnson	Allen
	Appalachian	Kentucky	Justice	Allen
	Appalachian	Kentucky	Louisa	Lawrence
	Appalachian	Kentucky	Moulder	Warren
	Appalachian	Kentucky	Mount Aerial	Allen
	Appalachian	Kentucky	Neals Creek	Lincoln
	Appalachian	Kentucky	Rousseau	Barren
	Appalachian	Kentucky	Spencer Hiems	Wolfe
	Appalachian	Kentucky	Stamps	Allen
	Appalachian	Kentucky	Steele Creek	Floyd
	Appalachian	Kentucky	Stringer	Simpson
	Appalachian	Kentucky	Sturgeon Creek	Lee
	Appalachian	Kentucky	Susie	Wayne
	Appalachian	Kentucky	W. G. Oliver	Warren
	Appalachian	Kentucky	Wheat	Allen
	Appalachian	West Virginia	Sandy Summit	Roane
	Mid-Continent	Oklahoma	Agra	Lincoln
	Mid-Continent	Oklahoma	Baird	Cotton
	Mid-Continent	Oklahoma	Davenport	Lincoln
	Mid-Continent	Oklahoma	Deep Fork	Okmulgee
	Mid-Continent	Oklahoma	Duncan (North & West)	Stephens
	Mid-Continent	Oklahoma	Gilliland	Osage
	Mid-Continent	Oklahoma	Hewitt	Carter
	Mid-Continent	Oklahoma	Hominy Falls (21-11)	Osage
	Mid-Continent	Oklahoma	Keystone	Pawnee
	Mid-Continent	Oklahoma	Kilgore	Grady
	Mid-Continent	Oklahoma	Knox	Grady
	Mid-Continent	Oklahoma	Oglesby	Washington
	Mid-Continent	Oklahoma	Okay	Wagoner
	Mid-Continent	Oklahoma	Pawhuska	Osage
	Mid-Continent	Oklahoma	Pearsonia	Osage
	Mid-Continent	Oklahoma	Pettit	Osage
	Mid-Continent	Oklahoma	Scott	Creek
	Mid-Continent	Oklahoma	South Beggs	Okmulgee
	Mid-Continent	Oklahoma	Sperry	Tulsa
	Mid-Continent	Oklahoma	Terra-Oklahoma	Muskogee
	Mid-Continent	Oklahoma	Turman	Okmulgee
	Mid-Continent	Oklahoma	Wetumka	Hughes
	Mid-Continent	Oklahoma	Wilcox	Okmulgee
	Mid-Continent	Oklahoma	X-686	Osage
	Mid-Continent	Oklahoma	Y-686	Osage
	Mid-Continent	No. Texas	Callihan-Grubstake	McMullen
	Mid-Continent	No. Texas	Desdemona	Eastland
	Mid-Continent	No. Texas	Fox	Eastland
	Mid-Continent	No. Texas	Roberts	Stephens
	Mid-Continent	No. Texas	Ivan-Eliasville	Stephens
	Mid-Continent	No. Texas	Janellan	Brown
	Mid-Continent	No. Texas	Mexia	Limestone
	Mid-Continent	No. Texas	Necessity	Stephens
	Mid-Continent	No. Texas	Wayland	Stephens
	Mid-Continent	Kansas	Baldwin	Douglas
	Mid-Continent	Kansas	Bronson	Bourbon
	Mid-Continent	Kansas	Elbing	Butler
	Mid-Continent	No. Louisiana	Homer	Claiborne
	Rocky Mt.	Wyoming	Belton Creek	Natrona
	Rocky Mt.	Wyoming	Crystal Creek	Big Horn
	Rocky Mt.	Wyoming	Derby	Fremont
	Rocky Mt.	Wyoming	G. P. Dome	Carbon
	Rocky Mt.	Wyoming	Iron Creek	Natrona
	Rocky Mt.	Wyoming	Kirby Creek	Hot Springs
	Rocky Mt.	Wyoming	Mahoney	Carbon
	Rocky Mt.	Wyoming	Mule Creek	Niobrara
	Rocky Mt.	Wyoming	Osage	Weston
	Rocky Mt.	Montana	Devils Basin	Petroleum
	California	California	Elk Hills	Kern
	California	California	Richfield	Orange

HIGH FENCES HOLD REFINERS' SECRETS DURING BOOM DAYS



Forerunner of the modern tube still. This type of pipe retort was used in the first Trumble units built in California. The above shows such a unit built in 1910

Gulfey Refining Co.'s plant located at Port Arthur, Tex. This later became the site of the Gulf Refining Co.'s 125,000-bbl. plant. The above scene depicts conditions at about 1904. The two batteries of shell stills equipped with vertical aerial condensers processed close to 24,000 bbls. of crude daily

REFINING—ERA NUMBER 4 1904-1919

Never hesitant in discarding the old for new and driving hard to improve the quality of each one of its growing number of products, refiners crowded into the past 30 years, practically all of the work that makes their industry the fourth largest in the country. Exceeded only by the automobile, steel and meat packing groups the value of refinery products has risen to more than $2,500,000,000 annually.

In the 15-year period from 1904 to 1919 the refining industry first deviated from its 40-year adherence to the simple distillation procedure and entered the truly manufacturing field. In that period it ceased to be satisfied with the products of nature as they were given to us so abundantly in crude oil and began to improve upon them. The principal contribution in the program of petroleum synthesis as we understand it today, was cracking. Without the advent of cracking we would not have been able to supply the present world demand for motor fuel. The phenomenal growth of the automobile and steel industries could not have been realized and our economic progress would have been slowed down to more nearly that of Europe for the same period.

First Cracked Gasoline

However, the effect of commercial cracking was not felt until 1913. In fact, it was not needed until the automobile began to fill that inherent desire of the American people to "go." In the meantime the world was learning more about the use of other petroleum products. It was consuming more kerosene annually. Better and a larger quantity of lubricants were needed to supply growing industries. The heavier oils were making fast progress toward becoming the "fuel of the seas."

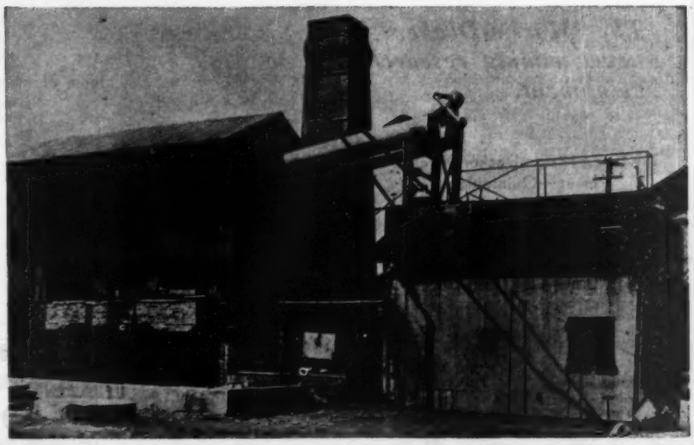
The refining industry met these early demands by building small plants in western Pennsylvania, West Virginia, Ohio and a few on the East and West Coasts but by 1904 new oil producing fields caused a shift and the major construction was concentrated, first in the Chicago area, then along the Gulf Coast, then in the Mid-Continent and little later in California. The density of population along the Atlantic Coast had favored the building of plants there as soon as suitable oil supplies became available, and a variety of crudes were processed.

All Very Secretive

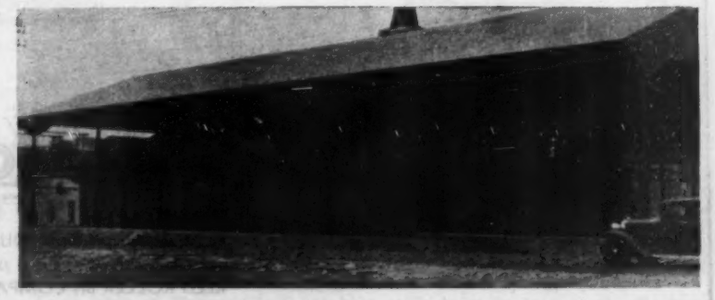
Secretive in every move taken, the early refiner made most of his improvements by the cut and try method. In some instances his efforts led him into unduly complicated designs. The cheese box still serves as an example but by 1904 the tendency was distinctly toward a standardization in favor of shell stills of 600 bbls. capacity or less, set upon solid walls of masonry, constructed in batteries but operated individually.

The industry learned early in its history to build "big and well" and under the leadership of the Standard companies then, that idea has become its slogan to this day. Maybe that thought came from the fact that the Standard plant at Whiting, Ind., had been made the largest in the world and by 1904 was being constantly enlarged and improved.

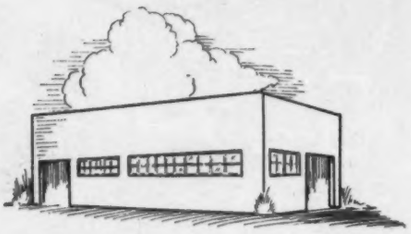
It was from this plant that word filtered out from time to time that a new process had been found to make synthetic gasoline but the official announcement of the Burton cracking process was not forthcoming for several years. Others



The pioneer in commercial cracking—the original Burton still at the Whiting plant of Standard Oil Co. (Indiana) in 1913



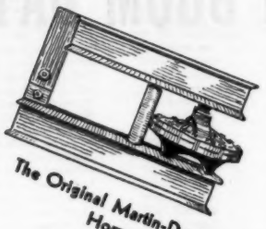
One of the first continuous shell still batteries. This unit was installed at the Fort Worth refinery of the Pierce-Fordyce Oil Co. in 1912



The Original Home of the First Practical Weight Indicator

From "STOOL PIGEONS" TO INSTRUMENTS

The First Practical Weight Indicator

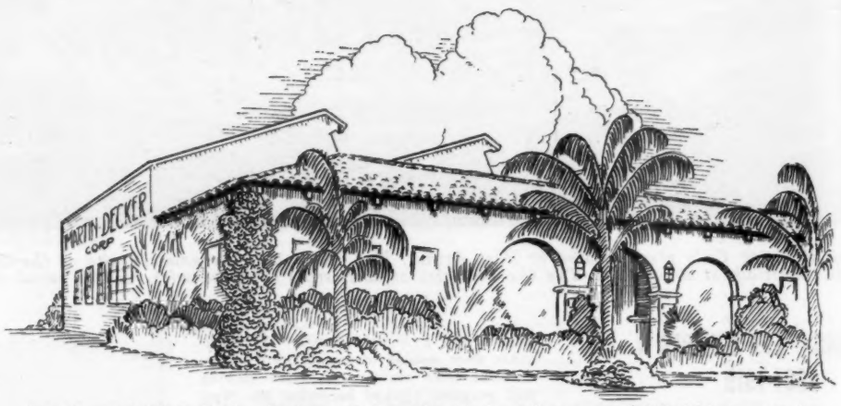


The Original Martin-Decker Pump Dynamometer and Home-Made Recording Device

IN 1926 the Martin-Decker Corporation introduced the first practical Weight Indicator. It met with a very discouraging reception. Drillers and executives looked at it suspiciously and called it a "stool pigeon." However, it did not take oil men long to find that there was a need for watching weight. In a short time this device was adopted as standard equipment on drilling rigs throughout the world.

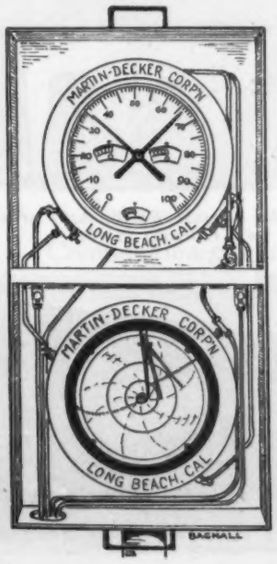
The intervening years since 1926 have seen many changes and advancements in the art of drilling and production. Martin-Decker have anticipated these developments and have been ready with Weight Recording, Measurement and Control Instruments when the need occurred.

The Martin-Decker pledge is never ending research and development.

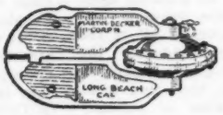


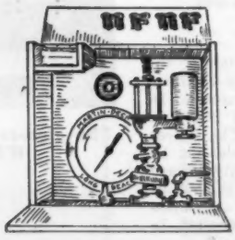
The Home of Martin-Decker Equipment. From this Modern plant comes Oil Field Instruments for Weight Recording, Measurement and Control.

The Latest Martin-Decker Development—Quintuplex —the Centralized Drilling Control Instrument



The New Martin-Decker Pump Dynamometer—the standard of the world





THE WEIGHT INDICATOR

MARTIN DECKER CORP.

LONG BEACH CALIFORNIA

San Joaquin Valley: A. F. McQUISTON, Oildale, California

Mid-Continent Distributer

REED ROLLER BIT COMPANY. Houston, Texas

A STATEMENT

By W. R. Martin, President

In 1861, Milt, Al and Jim Martin started on Oil Creek. In 1883, Jim was granted first U. S. Patent for a portable drilling machine. In 1934 we are still endeavoring to keep up with the procession.

First Burton-Clark cracking still

were equally busy developing and perfecting cracking equipment but all was done behind high fences.

Whiting's Importance

Whiting became a recognized center of chemical activities in the oil industry and from 1902 until 1907 there were in its research laboratories such well known chemical engineers as R. E. Humphreys, George W. Gray, F. M. Rogers, R. H. Brownlee and B. F. Carver.

Much real chemical engineering progress was also being made in the refineries along the Atlantic Seaboard, although developments there were less conspicuous. In the eastern refineries were to be found George M. Saybolt, chief inspector for the Standard Oil Co.; Clarence I. Robinson and E. B. Cobb, who have since held positions with the Standard Oil Co. of New Jersey. Others of this group included William Irish, J. W. Van Dyke and F. C. Robinson of the Atlantic refinery in Philadelphia; George H. Taber, of the Atlantic and later general manager of the Gulf Oil Co., and J. N. Pew, of the Sun Oil Co. of Philadelphia. Many chemical engineering developments were also under way at the Tide Water refinery at Bayonne, under P. R. Gray who served in process work from 1884 to 1910.

Because Whiting was considered a leader and was later to give the industry its first commercial cracking unit, a brief summary of the events that led up to this may be interesting.

Gave Up Picnic Grounds

The New York office of the Standard group had decided that the site of the plant, now Standard Oil Co. (Indiana), was to be on the Great Lakes near Chicago. A plot of ground occupied by Danish farmers seemed to suit the needs.

Whiting was destined to be a major manufacturing center even as early as 1889 so the choice was made. The next move was to secure title to the land. This was finally accomplished amidst a prolonged demonstration of tears and fists for many of the Danish farmers considered the erection of a refinery on their picnic grounds second only to the destruction of their homes.

Run Ohio Oil

The development of the Ohio oil fields had fully justified erection of the new plant. Ohio oil also introduced new refining problems due to its high sulphur content. Its removal had been worked out in the laboratory by use of the Frasch principles but it remained for the refinery to determine the full commercial value of the process when applied here.

Plans of the refinery came from New York in February, 1889, in the form of pencil sketches and in the hands of W. M. Irish, James A. Moffett and W. P. Cowan. The last was superintendent of the Standard's Cleveland refinery. Extreme secrecy called for making the detailed drawings in the home of William Curtis, master mechanic of the Cleveland plant. In general, the plans called for building the largest refinery in the world.

Systematic construction started May 5, 1889. All materials were paid for and the men were paid out of the pocket of W. P. Cowan. Only those close to the company knew this was to be a Standard Oil unit until October, 1889, when the name of the company was placed on the office building.

At first, this was a two-story frame affair which had been the home of one of the more prosperous farmers whose land had been purchased. The lower story served as the office and the upper half was equipped as a laboratory. It was to this laboratory that W. M. Burton came in 1890.

By this time, the plant comprised eight crude stills of 600 bbls. capacity each, four sweetening stills and several steam stills. A paraffin plant and grease works were added a few years later. Head light oil, water white and Standard white kerosenes were the principal products and all efforts were bent toward making as little gasoline as possible.

For the time being, Doctor Burton was confronted with the problem of applying the Frasch process to plant operation and his first years at the refinery were not productive of much which later identified his name with the "revolutionary" process.

Built, Torn Down, Rebuilt

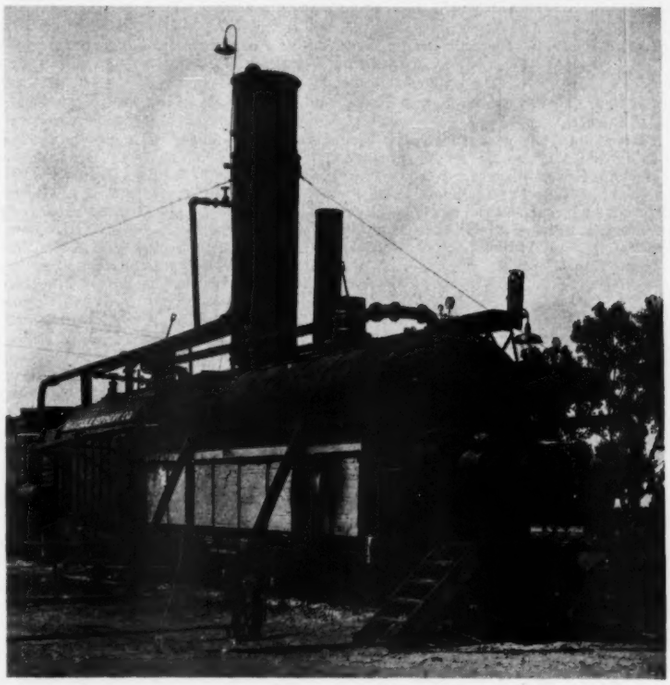
The willingness of the refining industry to spend large sums of money and then replace that which was built with something better was shown early in the example set by the Standard at Whiting.

The company had experimented with two types of stills for the removal of sulphur. Each involved the use of copper oxide. Those stills which were built to permit distillation of the oil in direct contact with the copper oxide were known as "sweetening stills." The others were constructed to cause the vapors to pass up through a bed of copper oxide and were called "vapor treaters." Both types were expensive to build and to operate.

Experience seemed to favor the vapor treaters and the company appropriated money for the conversion of a large number of the sweetening type to the vapor type. Work progressed until the job was half completed when out of a clear sky came the order from New York to standardize on the sweetening type.

The new industry lured men from all walks of life, probably because it paid well in proportion to other industries at that time and the gates of the plant were sometimes crowded. Stillmen received 56 cents an hour, labor 15 cents and pipe fitters 22 cents. All worked 10 hours a day.

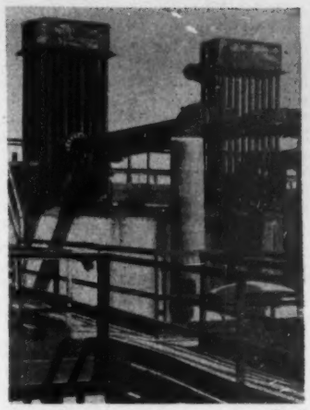
Under these conditions Doctor Burton took charge of all operations in 1895. As superintendent he directed the work of the plant as well as the research which was to make his name famous a few years later.



Portable refinery showing dutch oven operating in the Luling Field, Texas

Gulf Coast Gets Attention

As the twentieth century was ushered in, the attention of the industry was temporarily turned away from developments at Whiting. The Spindletop Field had been discovered in 1901 and this



Aerial-type condensers installed in one of the first Mid-Continent refineries. Cooling was accomplished by the air passing through the tube bank

was hailed as a new field for refineries. However, there soon appeared a wide diversity of ideas regarding the practicability of refining this crude. It was a typical asphalt base crude and those coming from the Pennsylvania and West Virginia fields were skeptical of its value. Practical men within the same company argued the point. It is stated by men who attended a chamber of commerce meeting in Beaumont, Tex., in those early days that a Standard executive made the statement that Spindletop crude was common fuel oil and was "not fit for refining." Within a few months, however, the Standard sent representatives to build a refinery along the Gulf Coast to process this oil.

Start of Gulf Organization

While this argument was in progress, J. M. Guffey, a practical, independent refiner was busy erecting a plant at Port Arthur, Tex. Unknown to him, of course, at the time, this plant was later to gain recognition as the largest refinery in the world but under the name of the Gulf Refining Co.

Mr. Guffey's complete plans called for a battery of stills capable of running 24,000 bbls. of crude daily and his plant was to be exceeded in capacity only by the Standard's 30,000-bbl. refinery at Whiting. He was able to buy crude oil at the well for as little as 3 to 6 cents a barrel, and the problem of expanding his plant marketing capacity became his major problem.

To move the products of the plant that grew from four shell stills and a crude capacity of 7,500 bbls. early in 1902 to the 24,000-bbl. plant late in the year, Mr. Guffey realized he would have to expand his marketing facilities.

In June, 1902, he was successful in placing $5,000,000 worth of bonds of his company among eastern bankers. Desirous of checking up on the investment, they had made, W. L. Mellon and George

Long lines of Burton-Clark cracking stills built in 1915 at the Bayway, N. J., refinery of the Standard Oil Co. of New Jersey. These have since been dismantled and replaced by Tube and Tank units

L. Craig visited the Guffey refinery on August 18, 1902.

By that time, the price of Spindletop oil was beginning to rise and had passed 10 cents a barrel. The prediction was generally made that it would go to 40 cents by the end of the year. Refined oil prices advanced in proportion and the business of the Guffey company grew. It soon became apparent, however, that additional expansion of refining and marketing facilities would be needed if the company was to take advantage of the position it held. To gain this end, Mr. Guffey relinquished his full control in 1902 when the company took the name of the Gulf Refining Co. The latter had been organized one year earlier by the Mellon interests.

Mr. Guffey continued to direct the operations of the company and under the new stimulus, its business doubled in the following year. The facilities for loading tankers were greatly expanded. A memorable event was the lifting of the Shell Transport & Trading Co.'s 65,000-bbl. tanker "Pinna" one day in June, 1902, followed by the 60,000-bbl. "Cardium" a short time later.

The Texas Co.

Port Arthur, Tex., was the birthplace of another major refining company during these years, namely, the Texas Co. J. S. Cullinan, originally interested in a refinery at Corsicana, Tex., but to whom much credit is given for organizing the Texas Co., announced in May, 1902, that he had erected 10 steel tanks of 37,500 bbls. capacity each and that crude was being segregated for processing through a refinery to be built at Port Arthur. A golf game with J. W. Gates is said to have led to the financing of much of the early work in the plant. The company was originally capitalized at $3,000,000 but only a little more than half of this amount was then issued.

The first "bright stocks" to be refined from non-Pennsylvania crude were made in 1911 at Whiting, by the Standard Oil Co. (Indiana). In 1903 the first steam refined stocks were made from "western" crude oil.

Burt Refinery

Southwest of Beaumont, George A. Burt was also busy getting materials ready for the erection of a plant. This plant developed into the large refinery now operated by the Magnolia Petroleum Co. Secrecy surrounded its building too. One record has this to say of the Burt plant: "A solid fence 25 feet high encloses the tract of land. There are about 300 or 400 acres." The amount of material entering the plant and the large force of men employed led to the early belief that it too would prove to be a Standard unit.

Gossip ceased a few months later when an instrument was recorded in the county court house at Beaumont transferring title to Samuel G. Bayne, president of the Seaboard National Bank of New York, for a consideration of $5,000,000. In May, 1903, the plant was operated as the Security Oil Co. The company immediately started to segregate oil that was available in the Spindletop Field and in June let a contract for eight wood lined earthen tanks each of 130,000 bbls. capacity to bring its total storage capacity to 2,280,000 bbls. Spindletop oil was selling at 70 to 80 cents a barrel by this time and production companies were declaring monthly dividends of as much as 19 per cent.

Gulf Coast End of 1904

Other refineries were built on the Gulf Coast to take advantage of the cheap Spindletop crude and a complete list by the close of 1904 would include: Gulf Refining Co., Port Arthur; Texas Co., Port Arthur; Colonial Oil Co., Port Arthur; United Oil & Refining Co., Spindletop, and Central Asphalt & Refining Co., Port Neches.

Throughout that year the Gulf Coast refining industry continued to prosper. It had difficulty in getting rid of all the gasoline made but fortunately the local crude did not contain much gasoline. An average refinery yield when running Spindletop and Humble crudes would have been as follows:

	Per cent
Gasoline (66 gravity)	3.1
Kerosene (120 flash)	14.1
Gas oil	55.0
Asphalt	25.1
Loss	2.7

First Auto Ads

General prosperity in this area prompted automobile ads to be placed in the local papers of the day and in the July, 1904, issue of the "Oil Investors Journal" there appeared one calling attention to the superiority of the two-speed "Oriental Buckboard," a one-cylinder, rear engine job priced at $425 and powered by a four horsepower gasoline motor. The entire automobile weighed 500 pounds. A few of the Gulf Coast refiners tried it out but were not convinced that this machine held the key to their problem of getting rid of all the gasoline they had to offer.

For many years it had been universal practice to distill crude petroleum in a number of steps, each of which involved a consequent loss of product as well as increased cost due to fuel, etc. It was a revolutionary step, therefore, when in 1905 William Irish and John Van Dyke, using their air-cooled, stone-packed tower, first distilled crude oil to coke in a single step. Twelve stills erected at the Atlantic refinery in Philadelphia attracted wide attention and after being investigated by a committee of refinery superintendents early in 1907, the method was widely adopted in the industry.

The continuous distillation of crude oil to a 15 per cent bottom using a battery of shell stills connected in a series was also first practiced at Philadelphia about the same time or just prior to the Van Dyke development.

Perhaps the next most important development in petroleum distillation was the introduction of the tube or pipe still with which the names of M. J. Trumble and the Shell Co. of California are generally associated. At first used on the Pacific Coast primarily for dehydrating and stripping purposes to run crudes of low gasoline content, the pipe still soon demonstrated its advantages over the older shell type still for many operations, including pressure distillation.

Those who were not so concerned with technical developments in the older refineries and had their minds on building new ones came to the Mid-Continent. This was occasioned by the discovery of the Glenn Pool near Tulsa. It marked the beginning of another scramble to build refineries in order to utilize the cheap oil producers were willing to pour out upon the market.

It should not be concluded that the Mid-Continent refining business had its beginning at the time of the discovery of the Glenn Pool, however, for oil was being produced in a few small pools prior to this and there were several refineries operating in the Mid-Continent.

One of these was built at Corsicana, Tex., by the J. S. Cullinan Co. under the supervision of E. R. Brown, later chairman of the board of the Magnolia Petroleum Co. Mr. Brown was the first superintendent of that plant and chose Christmas Day, 1898, to fire the stills for the first time. This plant later became a part of the Magnolia Petroleum Co. upon its organization in 1911.

Good and Bad Effects

The discovery of crude in Glenn Pool had its bad as well as good effects so far as the refining business was concerned. It opened up a new supply but it ruined the market.

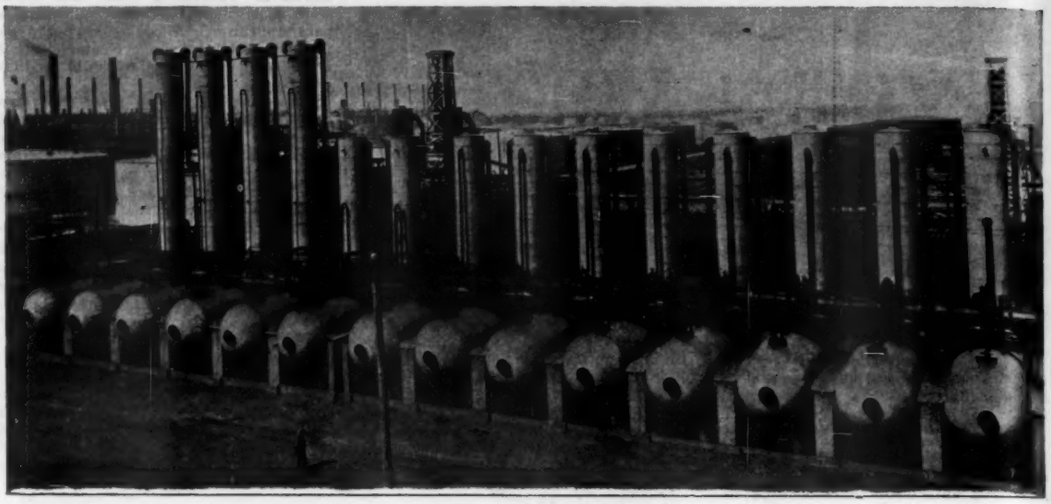
In 1907 a freight rate of 46½ cents a barrel was established on the tank car movement of oil to Beaumont, Tex., and the Prairie Oil & Gas Co. started concentrating oil at its Jenks, Okla., farm for shipment to the Gulf. This supplied a much needed outlet.

New Wood River Plant

To further aggravate the crude situation, new Illinois fields were brought in at this time and in March, 1907, the Standard Oil Co. purchased 400 acres of land at Wood River, Ill., on which to build the plant now belonging to the Standard Oil Co. (Indiana). This gave the Standard another plant from which to ship into the Northwest and with those located at Whiting and Neodesha, Kans., the latter the first refinery to be built west of the Mississippi River, the scene was being laid for the coming of a great pipe line system to connect these units and supply them with Mid-Continent crude.

In the four years that followed, Oklahoma became a leading oil producing state. In the brief space of 10 years Oklahoma had increased its output of crude from 10,000 bbls. in 1901 to 56,069,637 bbls. in 1911. The Cushing Pool had been discovered and added to the available supply of cheap oil for such new plants as might be built. The temptation was too great and a program of plant construction started and extended over a 10-year period.

But the Mid-Continent area was not the only one to witness this boom, the Eastern Seaboard refiners, those in Penn-



Large battery of steam stills installed at Port Arthur, Tex., refinery of the Texas Co. about 1914. Used in rerunning benzine. This battery is no longer in operation

Removing coke in a batch still operation of a few years ago. A chain coiled in the bottom of the still was pulled by machinery, loosening the coke which dropped into plant box cars

sylvania, along the Gulf Coast and California enjoyed a rapid expansion. Even the 5,000-bbl. plant of the Midwest at Casper, Wyo., was increased to a 10,000-bbl. unit in 1912.

Good Export Market

The export market received the principal attention of the coastal refineries and in the second half of 1911 and all of 1912 orders were placed for about 100 new tankers. The country was getting its first real taste of gasoline demand from the automotive industry. By the end of 1913 there were approximately 825,000 cars registered in the United States and predictions were made that year that the number would reach 1,000,000 in 1914.

Cheap fuel oil and realization on the part of railroads that the oil business was here to stay, caused many coal burning engines to be converted to oil. This program aided refiners greatly in getting rid of the increasing volume of heavy bottoms.

Announce Synthetic Gasoline

The periodic rumors that were given publicity to the effect that someone had invented a synthetic motor fuel and that it could be made more cheaply than gasoline did not retard building. These rumors took more definite shape on March 1, 1913, when the Standard of Indiana made a significant announcement of a new "motor spirit."

The company was quite modest about its new product and the plan was to place it upon the market on trial for one year. It was to cost the consumer 3 cents a gallon less than straightrun gasoline. A laboratory inspection report stated that the "new motor spirit resembled gasoline in distillation range, was yellow in color and had a pungent odor." It was expected to be used only in stationary engines and motor trucks.

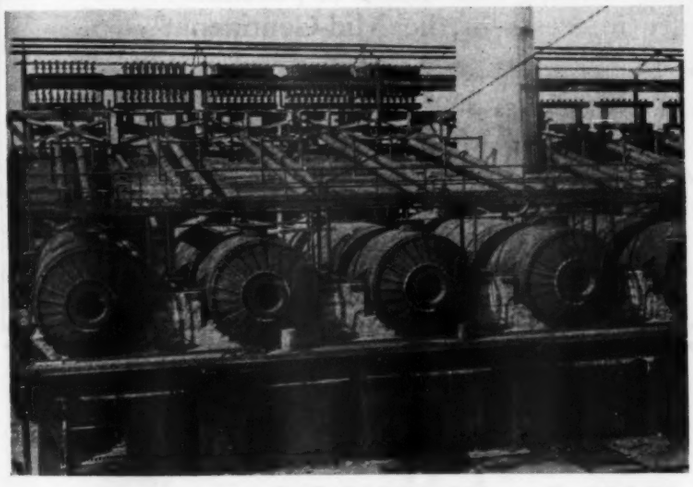
In this apologetic manner, cracked gasoline was placed on the market. This type of announcement did not seem to be justified after so many long years of research but it did not dampen the enthusiasm of those engineers delegated to improve upon it.

The announcement seemed to serve as the signal for the concentration of work on several other types of cracking units and in the years which immediately followed 1913, cracking and fractionation brought into the refining business a great number of technologists and engineers who have since helped to bring refining to its present high state of efficiency.

Burton Motor Spirits

Burton motor spirits, synthetic gasoline or Burton cracked gasoline as we would call it today, was the mystery product of this, the first commercial cracking unit. Construction of the unit had started in the summer of 1912, the original patent was filed on July 3, 1912, and on January 7, 1913, the first of the Burton patents was issued (No. 1,049,667). A few months later the company constructed 40 more units at Whiting and placed them in operation upon completion.

Of the earliest processes other than the Burton, that have been adopted on a large scale, the best known includes that developed by Carbon Petroleum Dubbs and owned by the Universal Oil Products Co. of Chicago; the Cross process, of which Walter M. Cross and Roy Cross of Kansas City, Mo., were the inventors; the Holmes-Manley process, which derived its name from R. C. Holmes and F. T. Manley, of the Texas Co., and the so-called Tube and Tank process of the Standard Oil Co. of New Jersey, which was invented by Carleton Ellis and has since been modified and developed by engineers in that organization. The Isom still, developed by the Sinclair Refining Co., takes its name from Edward W. Isom. The Fleming process once quite popular but now obsolete was developed by Richard Fleming of New York. The Hall, Rittman and Greenstreet processes, once used have ceased to be identified as practical and the good principles of each have been absorbed in other units. The Jenkins process enjoyed attention in later years but then lost much of its prominence. Among chemical processes the aluminum chloride method developed by A. M. McAfee and George W. Gray was utilized by the Gulf Refining Co. but has been abandoned. The Doherty process was generally adopted by the Cities Service group of refineries but its use has been restricted to these plants. The Winkler-Koch units and the de Florez cracking heaters have proved especially popular in the more recent years.



Row of Burton stills at Whiting plant of Standard of Indiana showing radiators

Cracking Litigation

The earliest disclosures of liquid phase cracking are shown by the patents, Benton, Schuchow-Gavrilow, Dewar and Redwood, Dubbs and Burton.

It has been stated that the cracking of oil was accidentally discovered in the winter of 1861 by a stillman at Newark, N. J. However, this is probably not the case, since a patent was granted to Luther Atwood, of New York, May 15, 1860, No. 28,246, in the U. S. Patent Office, which provides for the production of light hydrocarbon illuminating oils from heavy oils, paraffin, etc. The apparatus provides for the cooling of the heavy vapors and their return to the still for further cracking. However, this was carried out at atmospheric pressures.

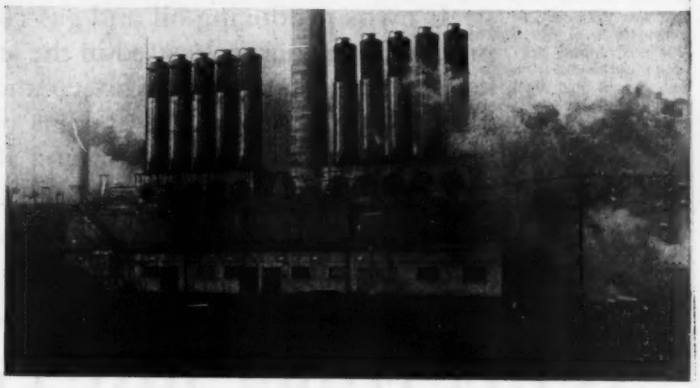
Disclosure of pressure distillation was made by James Young in his patent, No. 3,345 (English) of 1865, in which a distillation is described as being conducted in a vessel having a loaded valve or a partially closed stop-cock through which the confined vapors escaped under pressure.

The first extremely high pressure process was that of Benton, U. S. Patent No. 342,564, May 25, 1886. In this the oil was heated at a temperature of from 700 to 1,000° F. through a pipe leading to a low pressure expansion chamber, where it was vaporized, and then the vapors were condensed. The pressure used was as high as 500 pounds per square inch.

The Burton Process

Novelty in the Burton process was said to lie in the maintenance of pressure on the condenser. In the early operation of the original Burton process shell stills of 200-250 bbls. capacity each were used. These were heavy, horizontal steel cylinders, with walls one-half inch thick and thoroughly insulated. From the top of the still were long runbacks, exposed to the air, which returned any uncracked fractions to the cracking zone. The stills, the runbacks and the condenser were maintained under a pressure of about 35 pounds per square inch, the oil being heated to a temperature of about 750° F. Each still was charged every 48 hours, the yield being about 50 per cent of 48-52 degree distillate. The carbon which formed in the cracking zone was of a granular nature, and was easily removed after each run.

In the development of the Burton process, a difficulty that seemed insurmountable was the accumulation of carbon which deposited on the bottom of the still and caused overheating. It was not until R. E. Humphreys had introduced a false bottom of movable steel plate that this problem was solved. Further improvements to the Burton process were made by E. M. Clark, the most important being the replacement of the shell still by a tubular still constructed on the principle of the Heine boiler. This greatly increased the output because of the larger heating surface and because the rapid circulation through the tubes reduced the carbon deposition on the heating surface.



First towers to be used on Burton pressure stills

First High-Pressure Bubble Towers

In the years following the first commercial use of the Burton & Clark process, many important improvements in connection with this process were made which contributed greatly to the general development of oil cracking. One of the most striking of these was the discovery of the unexpected advantages of the bubble tower when used under pressure as part of a cracking system.

Dubbs Process

The Dubbs cracking process received very early attention, Jesse A. Dubbs having applied for some interesting patents as early as November 20, 1909. The first, No. 1,123,502 was issued to him January 5, 1915. This patent referred to carrying out the distillation under a self-generated pressure and served as a basis for an infringement suit brought by the National Hydrocarbon Co., owner of the Dubbs patents then, against the use of the Burton units in the Whiting refinery of the Standard of Indiana. By the end of 1926 some 18,000 to 20,000 pages of testimony had been taken in the courts.

The early advantages of the Dubbs process included that of easy cleaning. From the beginning it provided for the quick removal of coke from the reaction chamber. This was accomplished by suspending a cable around the inside of the chamber at the beginning of the run and when the run was completed the cable was pulled out and along with it came most of the carbon or coke. Having extreme flexibility in operation and permitting the reduction of the charge to coke, the exact operation depended upon the products to be manufactured.

A brief description of an early method of operation follows: The raw charging stock to be converted into gasoline and coke, whether gas oil or fuel oil, was pumped to the dephlegmator or directed to the heating element within a furnace or both. The temperature of the raw oil was raised to 820 to 900° F. under a pressure of upwards of 200 pounds. The heated oil under heat and pressure passed into the reaction chamber and as a function of the temperature, was vaporized and also deposited some coke in the chamber. The vapors passed out of the reaction chamber through a pipe connection to the bottom of the dephlegmator wherein the heavier portions were condensed to a liquid while heat was interchanged with the raw charging stock.

The mixture of raw charging stock and reflux condensate oil passed downwardly to the suction side of a hot oil pump, and was then pumped through the heating tubes where the oil was raised to the cracking temperature under prevailing pressure conditions. The uncondensed vapors in the dephlegmator passed out through the top to a condenser coil and were recovered as a distillate to be rerun. The pressure on the system was controlled by means of a gas release valve on the receiver. The excess gas over that necessary to control the pressure on the system was passed either through a scrubber with the gas dissolved in the pressure distillate or burned. The temperature control of the dephlegmator was of such a character that a distillate of any endpoint could be produced continuously. When the operation was outlined to produce a residual oil the control valve in the bottom of the chamber was partially opened so that the residual oil could pass to storage.

Cross Cracking Process

Roy and Walter M. Cross who operated the Kansas City Testing Laboratory at Kansas City started experimenting with cracking among the first in the field. Prior to 1913 numerous laboratory experiments had led them to believe that cracking could be advantageously carried out at about 600 pounds pressure and with temperatures ranging up to 900 degrees. The experimental work having passed through several proving stages, including a small commercial plant, and the first full size commercial plant was built for the Indian Refining Co. at Lawrenceville, Ill., and started operation in 1922. The licensing of the process was handled by Gasoline Products Co. and

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Besides these important assurances, an additional advantage of standardizing on Kennedy Valves, Malleable Iron Pipe Fittings and Cast Iron Pipe Fittings is that the Kennedy lines include a type and size for all your requirements.

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within a few years the number of Cross units in operation exceeded 150.

The Cross process was favored by many in the early days of competitive cracking because it produced a low carbon content residuum, was able to produce a high yield of gasoline and because its charge was a clean gas oil. Normally the charging stock was a 32-36° F. gas oil. This passed through the heat exchange coil in the dephlegmator where its temperature was raised to approximately 350° F. It was then discharged into the upper coils of the furnace. It passed through various coils and left at a temperature of about 850° F. It was maintained under a pressure of approximately 600 pounds per square inch. Less heat was required to effect cracking than if a lower pressure had been used, and this point was considered fundamental.

The heated oil passed into the reaction chamber where the conversion into gasoline took place. The oil was held in the chamber for a period of at least 15 minutes, and all free carbon deposited there as coke. The reaction chamber was a solid steel forging with walls at least 3 inches thick and without welds or rivets. The normal conversion was about one-third of the oil under treatment. The oil together with any gas that might have formed was discharged as hot synthetic crude out through a line containing a back pressure valve. This valve was the principal point of control. The hot synthetic crude was discharged into a vaporizer which was maintained at almost atmospheric pressure. In the case of gas oil 90 per cent was distilled to leave a 10 per cent fuel residue.

The synthetic distillate, together with the fixed gas, passed to a condenser coil to storage. Later towers were designed to permit finishing the gasoline directly from the unit.

Holmes-Manley Process

The Holmes-Manley process was an outgrowth of experimental work carried out by the Texas Co. at Port Arthur, Tex., for a number of years, and in 1920 the first large installation of the process was made. Ralph C. Holmes and Frederick T. Manley were then in charge of the refining department of the company and were active in supervising the work. In the next few years the Texas Co. continued building units of this type and its use by other refiners also became very widespread so that in 1928 there were over 150 units in operation. The Holmes-Manley process was one of the earliest continuous processes. It employed a coil heater for preheating the feed, which entered four reaction vessels in series where the bulk of the cracking took place, the evolved vapors being fractionated to separate the gasoline from unconverted fractions and the latter were subsequently returned to the heating coil for recracking. In later years it has been modified in various ways, including the substantial elimination of the liquid in the reaction chambers as a result of which antiknock values of the cracked gasoline have been increased and operating characteristics improved.

War in Europe

Along with having to digest news of the coming of a synthetic gasoline, the refining industry was brought face to face with an economic problem—war in Europe. When the first shot was fired in 1914, the oil industry realized that it would soon be called upon to supply larger quantities of gasoline and fuel oil. Prices began to advance in spite of the development of new major fields in Colorado, Oklahoma, Illinois, Texas and Louisiana. A real shortage of crude oil appeared on the horizon.

To give some idea of the rapid increase in the production of crude among the more important states the following figures are cited for 1913:

	Barrels
California	97,785,000
Oklahoma	63,579,000
Illinois	33,852,000
Texas	15,009,000
Louisiana	12,498,000

This production was in addition to the normal production in the eastern states which only a few years before had met the demands of the country. Scarcity of crude oil and the war in Europe had eliminated the fear of a pending price war between American and foreign interests, which had been strongly anticipated for years. Prices rose so sharply that in January, 1914, a Federal committee was appointed to consider building a refinery along the Gulf Coast which would supply the Navy with fuel oil.

Crude oil prices were not actually high at the time but only seemed high because the country had been used to 3 to 10-cent oil in Spindletop, 10-cent oil in Cushing and cheap oil in California.

On the other hand, a number of Oklahoma producers organized a committee which was sent to Washington to get the Federal Government to support an advance in the crude price to $2 a barrel. J. S. Cosden and J. S. Constantin, veteran refiners in the Mid-Continent, fought the idea.

By April, 1914, there were about 50 refineries operating on Mid-Continent crude including plants in Oklahoma, Kansas, Texas, Louisiana, Missouri, Illinois and Indiana. They had a combined capacity of 250,000 bbls. per day. At that time the new Cushing Field could supply about 65,000 bbls. daily and was already the largest high gravity oil field in the world.

It was fortunate that the Cushing Field had come no sooner for by this time the automobile industry was demanding a startling quantity of gasoline and this light crude yielded more than 30 per cent straightrun gasoline.

It was also becoming apparent that cracked gasoline was soon to be a competitor of straightrun gasoline for use in automobiles. A trial run in July, 1914, on the Indianapolis speedway in which cracked gasoline was used exclusively was the basis for this conclusion.

Trumble Process

The demand for a sharper separation between gasoline and kerosene coupled with the desire to reduce the investment in refinery equipment, directed attention to the new Trumble process. Two Trumble distillation units had been built in California in 1915, at a total cost of $75,000. One was located at Martinez, to run 8,000 bbls. of crude daily, taking overhead 30 per cent of the charge, and the other at Coalinga to run 2,000 bbls. daily, taking overhead 25 per cent of the charge. As might have been expected, these units were unusually compact and efficient.

Continuous Treatment

Continuous treating of naphthas came into prominence at the Bayonne refinery of the Standard of New Jersey, about 1913, although prior to that time much pioneer work on continuous acid treating of burning oils had been carried on in the New York refineries under the direction of Henry C. Smart. At Bayonne one of the New Jersey engineers had patented a process that involved a series of reaction towers or chambers in each of which there was a rotating device for mechanical agitation. A break in the agitating equipment accidentally proved that it was unnecessary in the process and mechanical agitation was later dispensed with, thus breaking the patent. The centrifugal pump method of treating naphthas in order to avoid excessive losses was developed at Bayway during the period William C. Koehler was in charge there.

Tank Car Shortage

After a little more than a year of war in Europe, in which inland refiners had participated in the supplying of oil for foreign consumption, there occurred an acute shortage of tank cars. This caused a tightening of transportation regulations but did not retard new refinery construction. By the close of 1916, the Standard Oil Co. of Kansas had 60 Burton stills in operation, 27 of which had been added that year. The Magnolia added 20 Burton stills at Beaumont, Tex. The Cudahy Refining Co. completed a lubricating plant in Kansas and the Sinclair Refining Co. began the construction of its Chicago refinery.

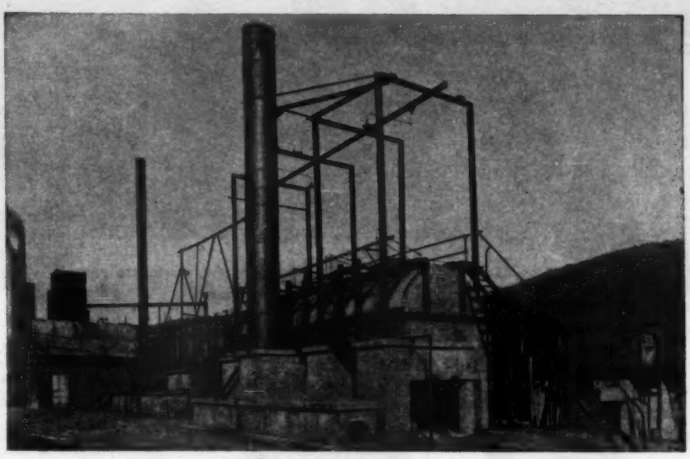
It was hard to get delivery on much of the material. Commitments were not made on heavy pieces of equipment for less than a year. Prices had gone up 100 per cent in 18 months. A new tank car worth $900 in 1914 cost $2,600 in 1916. A 55,000-bbl. tank costing $11,000 in 1914 was worth $25,000 in 1916.

The Federal Government was again concerned about the rising price of oil but nothing definite developed because all commodities were going up in price. It was at this time that the Federal Government offered the use of the vapor phase cracking process as developed by Doctor Rittman of the Bureau of Mines.

Headed Toward War

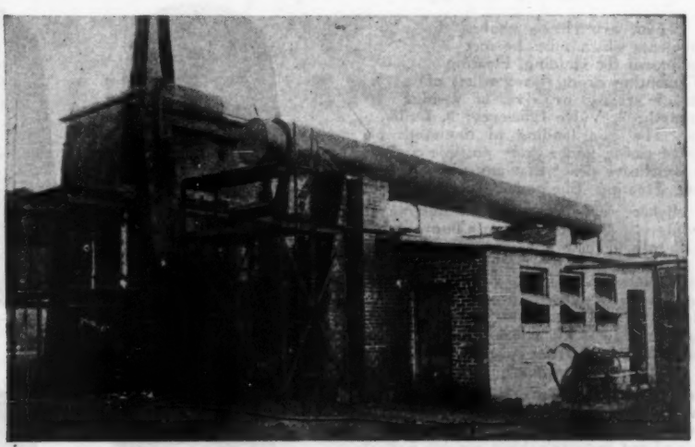
As 1917 approached, it appeared as though the United States was definitely headed towards war with Germany. In February of that year, 300 guards entered the employ of the Standard Oil Co. of New Jersey and a similar number was placed upon the payroll of the Tide Water to guard their seaboard plants, particularly those at Bayonne.

The destruction of the Rumanian oil



General view of Rittman unit at Pennzoil plant

The first full size Holmes-Manley cracking units at the Port Arthur plant of the Texas Co. in 1920



The first licensed Cross cracking process installation, at the Lawrenceville plant of the Indian Refining Co. in 1921

Baker Oil Tools have helped

1907—Casing Shoe

1922—Cast Iron "Rotary Hole" Guide

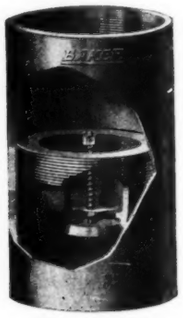
Above—Coalinga Plant—1913 Below—Huntington Park Plant—1922

R. C. Baker

1918—Plain Casing Shoe

1923—Float Plug Combination

1923—Float Shoe with Cast Iron Valve



1923—Float Collar with Cast Iron Valve

1927—Cement Float Shoe

1927—Cement Float Collar

1927—Cement Guide Shoe

1929—Cement Whirler Shoe

There are three vital requirements which must be met by equipment for Guiding, Floating and Cementing casing — regardless of length of string or size of casing: 1. Strength; 2. Valve Efficiency; 3. Drillability. The safe landing of thousands of strings of casing under every possible condition offers conclusive proof that any piece of Baker Cement Floating Equipment is entirely safe.

Baker Valve Efficiency for floating and *cementing* is secured by placing a buoyant bakelite ball in a bakelite chamber. Ample streamlined passageways permit unrestricted circulation of cement slurry. The bakelite ball, which floats in cement slurry, moves instantly upward when circulation is stopped and back-pressure develops, thus providing a leak-proof double-seal against rubber backed by bakelite.

Baker Drillability is secured and guarded by patented construction of the plug and valve assembly. Any internal construction which cannot be easily, rapidly and completely drilled out and circulated away is neither suitable nor safe.

The tendency of metal fragments to start off-vertical holes, and the difficulty of taking cores when metal is present are well known objections. Then, too, the cost and troubles encountered in disposing of metal in the hole should be carefully avoided.

Many years ago Baker determined that metals were not satisfactory for this purpose. The ideal combination, used by Baker, is a plug

(Continued on Next Page)

It was only natural that the immediate and universal success of the Baker Casing Shoe in 1907 should have prompted Mr. R. C. Baker, then a successful oil operator, to devote his combined inventive and practical genius to the development of tools and equipment for the safe, economical and satisfactory landing and cementing of casing.

The results of his efforts can best be visualized when we study the progress and history of the important operation of "casing" wells for the past 27 years. Always we find the latest and most efficient equipment marked "Baker," whether on the Casing Shoe of 1907, — on the Float Shoe with cast iron valve of 1923,—the Cement Float Shoe and Cement Float Collar of 1927, or the Cement Whirler Shoe of 1929, with patented internal construction of concrete and bakelite, free from metal or other materials difficult or impossible to drill out and dispose of.

A story, truly, of success and of attainment—of increased sales, added plants, enlarged payrolls. But of far greater importance to us—and to you—is the application of the knowledge gained through 27 years to making every product marked "Baker" *as good as it can be made*—to do your work a lot better, rather than to be *made good enough* and to cost you a little less.

All of us learned that lesson from Reuben Carlton Baker. His ambitions and ideals do not need to be repeated to Baker Men—they are part of us.

And that is why any Baker salesman looks you straight in the eye when he tells you: "Your casing and your well are *entirely* safe when you are using Baker Cement Guiding, Floating and Cementing Equipment."

That is why thousands of experienced, square-shooting oil men have been to Baker: first, prospects; next, customers; and then, friends,—some of them for 27 years in the past, and many, we hope, for that span in the future.

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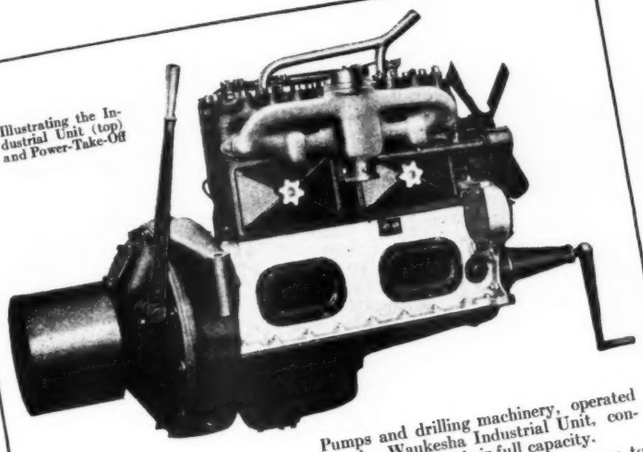

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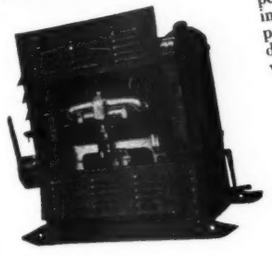


Waukesha
TRADE MARK

The Waukesha advertisement reproduced at the left appeared in the November 29, 1923, issue of Oil and Gas Journal. It marked the first appearance of Waukesha Engines in oil field service. The power unit shown is a 45 hp. gasoline engine.

Since that time more than 1,000,000 hp. of Waukesha Engines have been placed in oil fields—a most gratifying tribute to the steady progress and growth of Waukesha power plants in meeting the new demands and rigid requirements of the oil producing industry.

In striking contrast to the small but efficient gasoline engine used 10 years ago is the powerful oil burning engine illustrated below.

"Give us a Hesselman like your 300 hp. gas engine, and Waukesha will have the greatest line of any in the oil producing industry." So said the engineers and field men of the biggest oil companies.

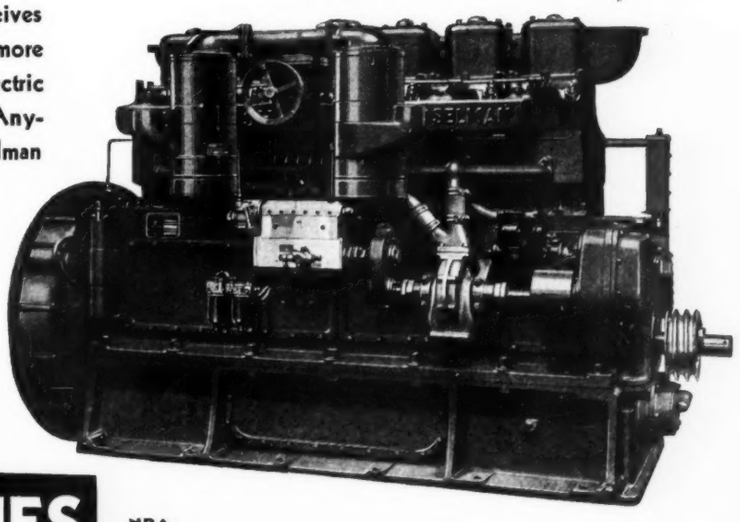
and here it is—

A 300 hp. FUEL OIL ENGINE for WILDCAT ROTARY DRILLING

The counterpart of the famous Waukesha LRO—built to burn fuel oils by the Hesselman method—the same fuels that medium to high speed Diesels burn, and with almost equal economy. It combines the convenience, moderate weight and long life of the gas engine with the low fuel cost and safety of the Diesel.

WAUKESHA-HESSELMAN PATENTED OIL ENGINE

A Hesselman is *not* a "semi-Diesel." Even though it receives a cold fuel charge by solid injection, it requires no more warm-up than a gasoline engine. And because of its electric ignition it starts as easily under all weather conditions. Anyone who knows gasoline engines will find the Hesselman simple to understand and easy to take care of.



Added features are—explosion-proof ignition system and water cooled manifolds...same speed range and speed control as the gas burning model.

Write for Bulletin 945.

WAUKESHA MOTOR COMPANY
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WAUKESHA ENGINES

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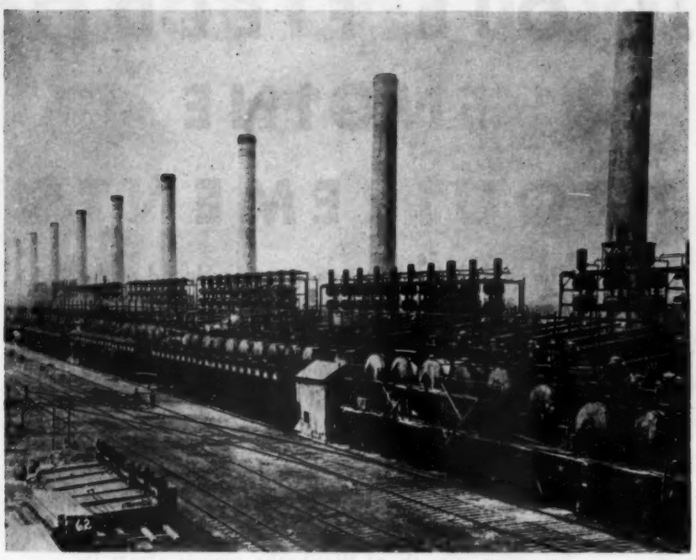
Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.



Coast stills built by J. S. Cosden at the West Tulsa refinery in what is now the Mid-Continent Petroleum Corporation's plant. These are being replaced by more modern units

fields by the Rumanians in preference to having them fall into German hands, placed an added load on the refining industry in this country.

Day by day we were moving closer to war. An order came to arm American ships. This prompted the question as to whether tankers should be armed. Oil was moving to both the Allies and to Germany. Entrance into the conflict would thus mean an abrupt falling off in a portion of the export business. Refiners realized this but also knew that a boom would follow. They had to prepare for an emergency.

Oil Ship Sunk

On March 18, 1917, the American oil family suffered its first casualty. The Illinois, an oil carrying vessel belonging to the Texas Co., was sunk by a submarine. It was returning to Port Arthur, Tex., in ballast. That same week, however, British authorities had delayed the American oil steamer, John D. Archbold, at Halifax where it was reported the mail was rifled. The steamer was on its way from Bergen, Norway, to New York. Then on March 21 the Standard Oil's ship Healton was sunk by a German submarine with a loss of 20 lives.

Despite these tragedies, more and more oil left this country for Europe. During 1917 and 1918 the refining industry witnessed a tremendous increase in the capacity of its plants.

Automobiles Increased

In addition to war needs, refiners had to supply fuel for a record number of automobiles. The number in the United States had grown to 3,250,000. In the brief span of 13 years, gasoline production had increased 10 times from 6,920,000 bbls. in 1904 to 70,000,000 bbls. in 1917. About 15,000,000 bbls. of this was cracked gasoline.

By this time a tank car shortage was working a real hardship on inland refiners. The Federal Government again concerned itself with the rising prices of gasoline. Refinery gasoline prices had been averaging better than 24 cents a gallon. Motorists were asked to refrain from unnecessary driving to conserve gasoline. Cracking was encouraged on every hand. Stocks of crude oil in Pennsylvania and the Middle West had been reduced to one-half in a single year.

At the same time, orders went out to speed up tanker construction so that larger quantities of fuel oil and gasoline could be shipped abroad. At this time, from 55 to 60 per cent of the gasoline manufactured in the United States was consumed in domestic cars. Twenty to twenty-five per cent of it was exported and the balance was used here in stationary engines, tractors, etc.

A new wave of refinery construction started. The Standard Oil Co. of Kansas added 20 more stills to its Neodesha plant to bring the total to 112 stills. The crude capacity was increased to 40,000 bbls. daily and the plant was recognized as the largest refinery in the Mid-Continent.

Refiners were next faced with a loss of personnel through enlistment but they gladly assumed the responsibility of supplying an increasing quantity of products and joined in the efforts to bring the war to an early and victorious end. They encouraged the purchase of Liberty bonds by their employes and provided a system of monthly payments to enable the men to buy a full quota.

Commandeer Fields?

Early in 1918 much was heard regarding the commandeering of oil fields on the part of the Federal Government. For the time refiners were concerned about such a move and to avoid it were ready to join hands to make effective any plan that would aid in systematizing the manufacture and transportation of refinery products.

Under the Council of National Defense each important industry had organized a committee to help correlate the manufacture and segregation of war supplies. The oil industry had such a committee. However, on December 27, 1917, the council relinquished its control over these committees and early in 1918 the petroleum war committee began to operate as an independent agency, but with the same purpose in mind.

The work of the original committee had been advisory and the appointments to it were generally made by the Federal Government. It included representatives of the Allies as well as of the U. S. Navy, Army and other interested Federal departments. The industry was well represented also by men in the refining, marketing and producing branches. The original committee had been headed by A. C. Bedford, chairman of the board of the Standard Oil Co. (New Jersey). On January 3, 1918, serving as head of the new and more independent committee, he asked that the general public conserve gasoline and other liquid fuels. He pointed out that stocks were increasing but that the war needs were mounting in Europe and the petroleum industry wanted to place itself in a position to meet any emergency.

Serving with him on the committee were: E. C. Lufkin, vice chairman, president, the Texas Co.; J. A. Moffett, secretary; C. C. Smith, assistant secretary and treasurer; J. W. Van Dyke, president, Atlantic Refining Co.; George S. Davison, president, Gulf Refining Co.; Thomas A. O'Donnell, director of production, U. S. Fuel Administration; H. L. Doherty, H. L. Doherty Co.; E. W. Clark, president, Union Oil Co.; H. E. Fulton, president, Union Tank Line; R. D. Benson, president, Tide Water Oil Co.; Martin Carey, general counsel, Standard Oil Co. of New York; Edward Prizer, president, Vacuum Oil Co.; Samuel Messer, president, Emlenton Refining Co.; J. C. Donnell, president, Ohio Oil Co.; A. G. Maguire, U. S. Fuel Administration; W. P. Cowan, president, Standard Oil Co. of Indiana; H. M. Blackmer, president, Midwest Refining Co.; J. S. Cosden, president, Cosden & Co.; W. C. Teagle, president, Standard Oil Co. (New Jersey); J. E. O'Neil, president, Prairie Oil & Gas Co.; H. F. Sinclair, president, Sinclair Oil & Refining Co.; J. H. Markham, Jr.; George W. Crawford, president, Ohio Fuel Supply Co.; J. H. Pew, president, Sun Co.; J. F. Guffey, president, National Gas Association; J. H. Barr, president, National Supply Co.; Frank Haskell, president, Mid-Continent Oil and Gas Association; W. S. Farish, president, Gulf Coast Oil Association; N. J. Byrne, president, Connecticut Oil Co.; J. A. Middleton, oil division, U. S. Fuel Administration; R. L. Welch, secretary, Western Petroleum Refiners Association; A. P. Coombe, president, Standard Oil Co. of Ohio, and Ivy Lee, director of publicity, national petroleum war service committee.

Embargo on Rail Shipments

An embargo on oil shipments by rail worked a hardship on some refiners and stocks of gasoline and fuel oil diminished at certain consuming points so that the problem resolved itself into one of transportation rather than a problem of the oil industry. Dr. Harry A. Garfield, fuel administrator, was assured of the cooperation of the oil committee and was advised that refined oil prices would be held at a reasonable level. This assurance halted the movement toward the fixing of prices by the Federal Government. Mark L. Requa, head of the oil division of the fuel administration, then offered the industry a rather free hand to organize its activities for supplying an adequate quantity of all necessary oil products with the principal thought in mind of making it easier to effect a speedy and successful termination of the war.

License Refiners

The Government requisitioned most of the tankers on the Pacific Coast. On February 4, President Wilson issued a proclamation in which he ordered the licensing of all refiners and marketers of fuel oil.

Crude Goes Up

On February 8, 1918, Pennsylvania oil went to $4 a barrel, the crude market strengthened in other areas also. While the President's order slowed down manufacturing in certain plants, new refineries continued to spring up. An idea of the status of refining may be obtained from the following summary made a few months previously.

REFINERIES IN THE UNITED STATES

(October 1, 1917)

State—	No.	Bbls. crude daily	Estimated investment
California	79	210,000	$110,000,000
Wyoming	5	48,500	30,100,000
Utah	1	500	35,000
New Mexico	1	150	20,000
Colorado	4	5,600	835,000
Texas	26	225,000	48,950,000
Louisiana	16	62,500	13,500,000
Arkansas	1	300	75,000
Oklahoma	66	177,300	134,876,500
Kansas	31	75,575	15,332,000
Missouri	6	27,300	3,810,000
Minnesota	1	300	40,000
Illinois	12	43,400	9,000,000
Indiana	1	60,000	25,000,000
Kentucky	3	3,500	1,125,000
Tennessee	1	400	15,000
Massachusetts	1	300	.....
West Virginia	6	6,100	3,000,000
Ohio	11	28,000	6,450,000
Pennsylvania	60	85,000	42,000,000
New York	9	36,000	65,000,000
New Jersey	12	146,100	90,000,000
Maryland	6	22,500	6,500,000
Total	359	1,265,325	$605,662,500

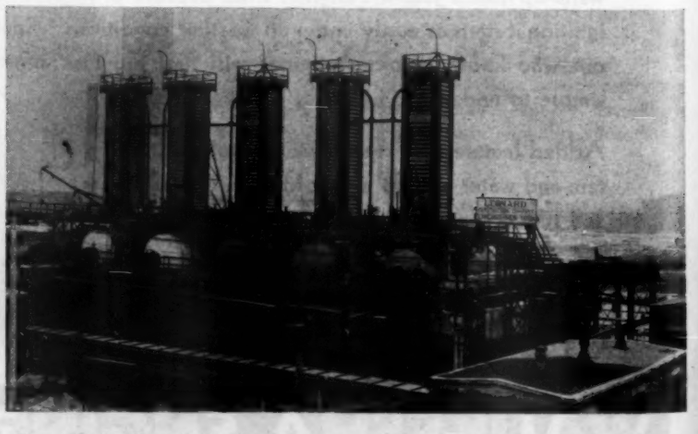
Idle, 24; active, 335; building, 118.

REFINERIES BUILDING OR PROJECTED IN THE UNITED STATES

State—	No.
Idaho	1
Montana	1
Wyoming	10
Utah	1
Texas	10
Louisiana	4
Oklahoma	47
Kansas	7
Iowa	1
Alabama	1
Illinois	6
Indiana	1
Kentucky	10
Tennessee	2
Virginia	7
West Virginia	2
Ohio	1
Pennsylvania	8
New York	1
New Jersey	1
Florida	1
Total	118

Order Tank Cars

Faced with the problem of moving the oil from the interior refineries the Mid-Continent refining companies ordered more than 5,000 additional tank cars for delivery in 1918. Some of the smaller refiners complained they could not get an adequate amount of crude oil, despite the payment of large premiums. On March 20 the Federal Government took over all supplies of fuel oil east of the Rocky Mountains. Failure of adequate and equitable distribution of fuel oil among the industries making war materials forced this move. In the Mid-Continent there was a tendency for refining activities to slacken for a time and stocks of gasoline and fuel oil began to increase. At this time, Mid-Continent gasoline was selling at the refinery for 17 cents a gallon and fuel oil was worth $1.90 per barrel.



One of the first battery of Isom cracking stills at the East Chicago, Ind., refinery of the Sinclair Refining Co., built in 1919. Unit has since been replaced with more modern equipment

Early manufacture of fancy candles at Standard of Indiana Whiting refinery

GASOLINE AND FUEL OIL DEMAND MADE EVENTFUL MARKETING ERA

MARKETING—ERA NUMBER 4 1904-1919

The period, 1904-1919, was probably the most eventful for the marketing branch of the petroleum industry. The waste product, gasoline, became the principal source of revenue; the heavy crudes of California and the Gulf Coast obtained premium prices and the exploitation of the Mexican fields was inspired by large increases in the requirements of oil burning installations. The growth of the automobile actually made it necessary to import gasoline. The movement to abandon coal in favor of fuel and distillate oils made considerable gains in the navies, merchant marine, railroads, and the stationary power installations of the world. Refinery technologists and automotive engineers advanced the wider and more effective utilization of the industry's fuels and lubricants. Manufacturers of all types found in petroleum products the means of reducing costs and improving the quality of their output. Non-staining, dripless and other special lubricants protected their products and increased the life of machinery; the easily controlled and steady heat provided by oil burners effected improvements of all types of manufacturered articles from bricks to steel girders and glassware.

In the World War the petroleum industry laid a debt upon the nations opposing the Central Powers that should have won eternal thankfulness and consideration. In the last year of this period appeared the state gasoline excise tax, levied first by Oregon, amounting to 1 cent to be used for highway purposes only. From this inoffensive beginning was to grow a burden of confiscatory proportions which today threatends to bleed the industry white.

Doctor Diesel's Engine

The engine patented in 1892 by Dr. Rudolf Diesel to burn coal dust, was in 1895 actually built, and in 1905 had been developed to a point where it began in a small way to replace crude gasoline and steam installations, particularly in Germany. The cycle of operations finally adopted by Doctor Diesel were: 1. A suction stroke during which air only at atmospheric pressure was drawn into the cylinder. 2. A compression stroke in which this air was next compressed adiabatically to a pressure of 500-600 pounds per square inch. 3. From, and for a short period after, the end of the compression stroke, regulated admission of the fuel in the form of a fine spray in such manner as to cause combustion to occur at approximately constant pressure. 4. Expansion of the ignited mixture of fuel spray and air during the remainder of the working stroke. 5. Expulsion of the burnt products during the next stroke.

The Diesel in 1897 had one cylinder, 9.8-inch bore, 15.7-inch stroke, 171.8 r.p.m., and developed 19.6 actual brake horsepower. The engine consumed 0.548 pounds of fuel per b.h.p. hour, and the brake thermal efficiency was rated at 25.2 per cent. In 1905, a three-cylinder Diesel engine making 154.5 r.p.m., developed 459 horsepower, used 0.451 pounds of fuel per b.h.p. hour, and was rated at 31.7 per cent b.t.e. In 1910 an engine was built with a brake thermal efficiency of 34.8 per cent. Maximum revolutions per minute up to 1914 were 380-450, and after that year was developed a Diesel operating at 800-900 revolutions per minute. Economy of space and increase in revolutions per minute led to the installation of Diesels at an early date in submarines and small water craft.

First oil going through Panama Canal. Col. Goethals shown on right

First Service Station

The first gasoline service station to meet the requirements of motorists who had been receiving their motor car fuel in 5-gallon cans and even barrels, appeared in 1908 in Vancouver. This retail outlet was established by C. M. Rolston, local manager for Imperial Oil Co., Ltd. In 1907 the U. S. Bureau of Corporations reported that most of the kerosene sold was from tank cars, stations and tank wagons supplying the dealers, and that packages were no longer being used to any extent.

It was not until the last years of this period that gasoline began to displace kerosene as the principal product. In 1911 consumption of kerosene in the various nations of the world, per capita, was reported as follows (figures indicate gallons): United States, 7.3; Canada, 4; England, 3.9; Germany, 3.6; Australia, 3.4; France, 2.5; Russia, 2; South Africa, 2; Egypt, 1.9; Rumania, 1.8; Austria, 1.8; Japan, 1.6; Brazil, 1.2; Italy, 1; Mexico, 0.7; India, 0.6; Spain, 0.5; China, 0.4.

Domestic demand figures are presented from 1917 by the U. S. Geological Survey as follows (figures in barrels of 42 gallons): Gasoline—1917, 56,313,000; 1918, 74,506,000; 1919, 81,783,000. Kerosene—1917, 24,803,000; 1918, 34,442,000; 1919, 33,188,000. Gas oil and fuel oil—1917, 131,633,000; 1918, 142,751,000; 1919, 163,803,000. Lubricants—1917, not available; 1918, 13,822,000; 1919, 13,600,000. Paraffin wax (in pounds)—1917, not available; 1918, 210,650,000; 1919, 190,969,000.

Expansion in the use of fuel oil by railroads up to 1917 is shown in the following table:

Year—	Bbls. (1)	Miles *(2)	Miles (3)	Miles †(4)
1906	15,577,677	.....	.....	....
1907	18,855,002	13,753	74,079,726	3.93
1908	16,870,582	15,474	64,279,509	3.81
1909	19,905,335	17,676	72,918,118	3.66
1910	23,817,346	21,709	89,107,883	3.74
1911	29,748,545	30,039	109,660,976	3.69
1912	32,605,593	28,451	121,393,225	3.61
1913	33,004,915	29,145	118,572,162	3.60
1914	31,093,286	29,595	116,737,469	3.83
1915	36,648,468	30,776	124,255,525	3.89
1916	42,126,417	31,980	146,434,566	3.33
1917	45,700,576	32,380	146,967,268	3.33

(1) Fuel oil consumed. (2) Length of line operated by the use of fuel oil. (3) Total mileage made by fuel oil burning engines. (4) Average number of miles per barrel of fuel oil consumed. *Some of these lines also used coal. †Decreasing mileage per barrel of fuel oil consumed is accounted for by the development of larger and heavier duty locomotives.

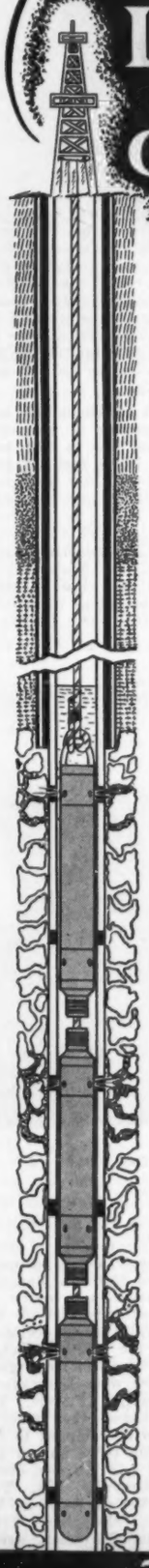
In 1909 the 300-ton Southern Pacific Railroad locomotive was built, and it was said at that time that "the necessity for oil burners in such monster constructions is evident, since stoking requirements with coal exceed the power of any fireman." In that year, also, nearly all of the stationary boilers operated by the Isthmian Canal commission were heated by fuel oil, and an actual saving in cost of 61 per cent, over the use of coal, was reported officially.

While in 1888 petroleum was used in only five locomotives in Rumania, in 1909 this number rose to 549, burning 179,966 tons of liquid fuel a year, and plans were made in that year for the addition of 80 more locomotives on fuel oil schedule in 1910. In Galicia, due to the increase in crude oil production, Austria heated 773 locomotives with fuel oil in 1909, while the Modena Railroad adopted the use of fuel oil burners on all locomotives operating in steeply inclined country and where tunnels were numerous.

Vessels loading at Pure Oil Co.'s dock at Marcus Hook, Pa.

In 1909 came the decision of the United States Navy and the British Admiralty to abandon the use of coal in vessels of war design and to utilize fuel oil. In the United States the battleships North Dakota and Delaware were equipped with auxiliary fuel oil burning plants. In spite of an accident in the fireroom of the North Dakota, in which two lives were lost from ignition of the oil, the tests were so satisfactory that the battleships Florida, Utah, Wyoming and Arkansas, then under construction, were to be equipped to carry 400 tons of fuel oil to be burned as an auxiliary to coal, and the new destroyers, Paulding, Drayton, Roe, Terry, Perkins, Sterett, McCall, Burrows, Warrington, Mayrant, Monaghan, Trippe, Walke, Ammen and Patterson, were to carry more than 200 tons of fuel oil and to be oil burners exclusively. The decision of the British Admiralty to change to fuel oil went far to strengthen the failing Scotch shale oil business. Quantity and value of oil shale produced in

A LAXATIVE for OIL WELLS



A CHEMICAL PRESSURE WASH to increase production in sluggish wells, reopen abandoned wells and clean the rotary mud, etc., out of new wells. This is accomplished with ABSOLUTELY NO INJURY TO CASING OR CEMENT.

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BEYOND THE EXPERIMENTAL STAGE. The chemical pressure wash has been eminently successful in treating all types of wells, and is a reliable and tested method. A trial will convince.

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Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

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England was 2,967,057 long tons, at $3,970,575 in 1909. Practically the same output in 1915 brought $4,071,280.

Naval Reserve Established

Consumption of fuel oil by the U. S. Navy in the fiscal year ending June 30, 1917, was 2,079,580 bbls., an increase of 147 per cent over 1916. In 1916 electric drive was installed on the dreadnaughts California and Tennessee, and it was predicted that fuel oil consumption would be less compared with that in direct steam driven units. In order to secure the Navy a future supply of liquid fuel the President on December 6, 1916, approved orders creating naval oil-shale reserves Nos. 1 and 2, involving, respectively, 45,440 acres in Garfield County, Colorado, and 86,584 acres in Uinta County, Utah, capable of producing, after mining and distillation, a minimum of 500,000,000 bbls. of oil suitable for marine use. In 1912 the President had set aside about 100 square miles of oil-producing lands in the Elk Hills and Buena Vista fields of California as Navy reserves. Bunkering stations were installed at Boston, Melville, R. I., Norfolk, Charleston, and Key West, all of 36,000 bbls. capacity. At Guantanamo, Cuba, the tanks were of 223,000 bbls. capacity, and at Pear Harbor, Hawaii, 200,000 bbls. Construction was started in that year on bunkering stations at New York, San Francisco, San Diego, Puget Sound, Guam, and Cavite.

In 1913 the Navy tanker Maumee was equipped with 2,500-h.p. Diesel engines and two 300-h.p. dynamo Diesels. Interest in the Diesel installations reached a high pitch in 1912 when a number of large vessels thus equipped visited these shores. The Hagen, with a displacement of 8,350 tons, and 400 feet length, made a trial trip in 1913 in lower New York Bay. The vessel was equipped with two 6-cylinder Diesel engines of the two-cycle type to develop 2,500 horsepower. The ship ran at 11 knots per hour.

Writing of the petroleum industry in 1915, John D. Northrop said: "The marvelous development of the automobile industry in the last decade, particularly since the advent of low-priced cars, has resulted in a demand for gasoline and lubricating oils that has taxed the industry to its utmost and has at the same time created an interest and concern in that industry which is as vital as it is country wide." The year was characterized as a period of readjustment from the depressed conditions arising from overproduction in the Cushing Field in Oklahoma.

From the beginning of the European conflict in 1914, petroleum was in huge demand with the development of necessary means for rapid transportation of men, munitions, and food on land; of the submarine and the submarine chaser on the sea, and, most important, aerial warfare and the fleets of scouting, conflict and observation airplanes. Surface reserves of crude oil in the United States were depleted at an unprecedented rate because the average oil operator had difficulty in obtaining supplies, and was harassed by labor troubles, lack of confidence in the stability of the petroleum market, shortage of water for drilling, uncertainties of pending tax legislation, absence of adequate marketing facilities for crude oil, scarcity of promising territory, and other factors tending to discourage the investment of capital in so hazardous a business and the search for crude oil. Prices, however, were revised upward generally, after the Cushing Field started its sharp decline.

First white oil filling room at Whiting refinery of Standard of Indiana.

Tractor and Airplane

Before proceeding to the statistics of this period, developments of particular interest may be presented here. It was in 1905 that Holt introduced his "caterpillar" tractor, which was represented in the World War as the important "tank." In 1905 Wilbur Wright made the first "long distance" flight in a heavier than air machine, covering 24 miles. In 1908 Wilbur Wright flew 77 miles in two hours, 20 minutes and 23 seconds, and his brother, Orville, flew 50 miles in 1 hour and 15 minutes. Harry Farman, in 1909, set a record with a flight of 112 miles in 3 hours, 4 minutes and 57 seconds. In 1909 O. Wright set an unofficial world record for altitude with 1,600 feet. The first flight across the English Channel was made by Louis Bleriot on July 25, 1909, covering the 32 miles in 37 minutes. Santos Dumont, of Argentina, made the first flight in Europe in 1906. Glen C. Curtiss, American, described the first "figure 8" in 1909.

Count Zeppelin, in 1908, was enabled by a popular German subscription, to build a plant to turn out eight dirigibles a year. The first Zeppelin to prove a success went up on March 9, 1909, and three days later rose to an altitude of 4,300 feet above Lake Constance. On March 19, the ship carried 26 passengers to a height of 1,000 feet. The ship was 446 feet long and contained 536,000 feet of gas in its 17 compartments.

Between 1909 and 1914 there were various proposals for air mail. In 1910 a conference was held at Paris to draw up international conventions in connection with aviation. Between March, 1912, and November, 1913, the German rigid airships, "Victoria Louise," "Hansa" and "Sachsen" plied between Berlin and Friedrichshafen in 881 flights and carrying 19,105 passengers 65,500 miles in comfort and without accident. In 1914 airplanes were developed capable of going 50 miles into enemy territory. The first planes had no armament. Pistols, rifles and later, machine guns were added to the plane equipment. Experimental radio was also introduced in the planes in 1914. In May, 1915, the German Fokker appeared with the machine guns synchronized to shoot between the propeller blades. On August 25, 1919, the first London-Paris air route was opened. Air mail was carried to Paris on November 10. In 1919 the British airship R-34 flew from London to New York and back.

Automobile Development

The automobile, in 1909, was considered to have passed the experimental stage, although operators of motor transportation service found business unprofitable. However, they continued to operate uncomfortable "taxis" until 1914. In 1915 the all-steel body was introduced. The windshield and folding top had become standard equipment in 1910, the year in which the first closed car was introduced. In the following year the airplane was first used in warfare, Italian aviators nearly destroying an entire Turkish army caught in a ravine, and showered with bombs. In 1919 the United States began to export fast and comfortable motor buses to England. In 1915 an electrically heated carburetor was invented for burning kerosene in automobiles. In 1912 the demand for gasoline had grown to such an extent in the United States that it became necessary to import gasoline on the Pacific Coast from the West Indies. In the following year the Burton cracking patent served to ease this situation. In 1917 the automatic oil heater was placed on the market by the inventors, M. J. Hammers and C. L. Lewis, and was offered as a power plant for trucks, tractors and other motor vehicles, hoisting engines, and for firing household boilers and furnaces.

In 1905 was carried out the successful experiment of towing a specially constructed barge transporting 6,000 tons of oil across the Atlantic, by a steamer, the Col. E. L. Drake, itself carrying 4,000 tons of oil for the Standard Oil Co. Up to 1900 the world's seagoing tank vessels, 193, represented a tonnage of 637,014 deadweight tons. In 1914 the number had risen to 441 vessels, of 2,343,877 deadweight tons. At the close of this period the number of tankers reached 780, and the tonnage mounted to 5,053,242 tons.

Candle machine which molds fancy candles of all shapes and colors.

Gasoline Consumption

Demand for gasoline for 1918 was estimated as follows: For pleasure automobiles, 20,000,000 bbls.; for export, 15,000,000 bbls.; for commercial automobile service, 12,000,000 bbls.; for U. S. Army, 8,000,000 bbls.; for stationary gasoline engines, 8,000,000 bbls.; for other uses, 10,000,000 bbls.

Average crude oil prices for the various fields from 1905 were as follows.

Year—	(1)	(2)	(3)	(4)	(5)	(6)
1905	1.3937	0.873	0.644	0.561	0.240	0.245
1906	1.5975	0.907	0.745	0.454	0.457	0.229
1907	1.745	0.913	0.6737	0.4075	0.884	0.370
1908	1.78	1.003	0.672	0.393	0.598	0.523
1909	1.6462	0.907	0.640	0.368	0.707	0.464
1910	1.333	0.793	0.593	0.385	0.65	0.49
1911	1 293	0.821	0.63	0.479	0.689	0.477
1912	1.626	0.932	0.851	0.692	0.742	0.484
1913	2 45	0.493	1.27	0.9292	0.90	0.35
1914	1.9167	0.472	1.1842	0.7858	0.5383	0.3917
1915	1.6292	0.522	0.9683	0.5792	0.4592	0.3543
1916	1.4833	0.945	1.645	1.2567	0.7875	0.6917
1917	3.20	1.854	1.945	1.775	0.9917	0.8875
1918	3.974	1.445	3.32	2.1875	1.4417	1.1791
1919	4.135	1.524	3.485	2.286	1.119	1.34

(1) Appalachian to 1912, thereafter Pennsylvania; (2) Lima-Indiana to 1912, thereafter Salt Creek; (3) Illinois; (4) Mid-Continent; (5) Gulf Coast; (6) California.

The record of exports was as follows (in gallons):

Year—	Crude oil	Gasoline	Kerosene	Lubs	Resids
1905	126,185,187	28,419,530	881,450,388	113,730,205	70,727,377
1906	148,045,315	27,544,939	878,274,104	151,265,522	64,644,765
1907	126,306,549	34,625,525	905,524,296	152,028,855	75,774,754
1908	149,190,017	42,587,044	1,129,084,823	147,769,024	77,551,633
1909	170,387,773	48,758,675	1,046,401,072	161,629,609	121,966,249
1910	180,111,166	100,695,382	940,247,089	162,832,544	117,605,882
1911	261,543,355	137,294,606	1,112,295,006	153,319,645	133,979,087
1912	188,711,420	186,000,094	1,026,138,239	216,293,206	266,236,988
1913	194,469,634	188,042,279	1,118,441,243	207,639,092	426,872,273
1914	134,735,553	309,692,655	1,016,449,265	191,647,570	702,508,931
1915	153,263,069	291,680,031	826,963,645	229,678,725	813,216,599
1916	172,027,905	355,870,221	854,653,404	260,305,939	964,039,337
1917	172,121,195	416,873,544	668,156,487	280,437,663	1,134,524,189

GAS INDUSTRY GIVEN NEW LIFE BY FOURTH ERA DISCOVERIES

The Foster well in the McKeesport, Pa., gas field

NATURAL GAS—ERA NUMBER 4 1904-1919

In the fourth period of the natural gas industry, 1904-1919, the long predicted end was postponed indefinitely by important discoveries in the South and West, and the finding of new gas areas and deeper sands in the old productive regions. The record of achievement in technology and utilization in this period outweighed the amazing record of waste in the new fields. Laws were in effect to prevent dissipation of this ideal fuel and source of important by-products, but billions of feet of gas continued to blow into the air.

In 1908 Wisconsin was the first to establish heating value, rather than candlepower, as the basis of quality regulation of gas, providing that the B.t.u. monthly average should be maintained at not less than 600, and at no time below 550. The Bureau of Standards took up photometric and calorimetric investigations in 1909, and the heat content basis was established by 1912, although as late as 1920 municipal regulations based on candlepower were in effect.

It was not until after 1906 that the U. S. Geological Survey was able to record the production and consumption of natural gas in terms of cubic feet. After that date meters were in general use. While manufactured gas was selling for as high as 95 cents per 1,000 feet, the metered natural gas sold for as little as 2 cents per 1,000 feet, but the day was dawning when the gas companies could go farther afield for customers who would pay a fair price for natural gas service, and the industries which had made the most of their proximity to the gas-producing areas would no longer hold the whip hand.

Reference was made in the article covering the third period to methods of natural gas measurement in use near the end of the third period, 1889-1904. In 1907 considerable attention had been given in Germany to the measurement of fluids by means of orifice meters, and still earlier, by more than a century, Henri Pitot had devised the tube bearing his name. The Pitot tube was developed as an accurate instrument by B. C. Oliphant, in 1910, and in the following year, John G. Pew and H. C. Cooper, of Peoples Natural Gas Co., found that the formula for the principle of the Pitot tube, wherein the velocity of a flowing fluid as indicated by the difference between the static and the dynamic pressures corresponds to the volume of the fluid flowing, would apply for an orifice. These investigators installed the first orifice meter in the line of Hope Natural Gas Co. at Hastings, W. Va., in November, 1911. Thomas R. Weymouth, of United Natural Gas Co., Oil City, used a straightedge disc one-eighth inch thick, and the downstream pressure as the static pressure, where Pew and Cooper used an orifice which was beveled on the downstream side, and the upstream pressure was the static pressure. The "bomb shell" gauge, to record the differential in pressure from one side of the orifice to the other, was developed in 1911 by the Peoples company, and gauge manufacturers later produced the mercury float type now in use generally.

From Henri Pitot, and probably before, to the present, the basis of meters of the above types rests on the simple fact that a fluid (such as gas) flowing through a restriction loses pressure in so doing in proportion to the square of the volume going through the restriction. Weymouth discussed the meters which came into wide use in 1911 and afterwards as follows:

"The venturi meter is used principally for low pressure measurements, and while extremely accurate, is handicapped by possessing a complicated formula for the expression of volumes, which renders very tedious the computation of results from its records, and which demands a knowledge of the ratio of specific heats of the gas at constant pressure and constant volume, respectively. The Thomas electric meter is likewise an extremely accurate instrument for the measurement of gas and is comparatively simple in construction. It operates on the principle that the energy required to heat any quantity of a given gas through a definite temperature range is directly proportional to the weight of the gas heated, and can therefore be used as a measure of it. The method is independent of the actual temperature and pressure of the gas entering the meter, depending solely upon its specific heat at constant pressure."

Weymouth's Formula

Although numerous investigators have studied the problem of determining equational values and relations of the various characteristics of natural gas in order to ascertain more accurately by calculation the actual conditions of volume, pressure, specific gravity or temperature of the gas, or diameter, length, or the plurals in more complex systems, of the pipe line required for a specified service, the formula of Thomas R. Weymouth, announced in 1912, today remains the standard. In some of the latest experiments it has been found that in pipe diameters exceeding 22 inches, the negligible error encountered in calculation with Weymouth's formula increases somewhat. Other investigators point out, however, that the value of applying many small corrections to pipe line flows, such as small differences in elevation between the inlet and outlet of the line, reduced diameter fittings, the effect of bends, right angle turns, metering stations, drips, type of joints, and length of pipe between joints, is often greatly diminished because of conditions affecting individual lines such as unsteady rates of flow, storage, and drainage taking place, the presence of condensates, rust and foreign material in the line, and the relative roughness of the interior walls of different lines. The U. S. Bureau of Mines, however, is contributing much to the knowledge of conditions relating to gas flows in pipe lines, so that until some simple (for practical purposes) formula for the larger diameters is worked out, the operator must rest content with larger errors or employ parallel lines of smaller diameter than 22 inches in place of the larger pipe.

The Weymouth formula for the transmission of gas is:

$$Q = \frac{871 D^{2.667}}{\sqrt{L}} \sqrt{P_u^2 - P_d^2}$$

in which

Q = quantity in cubic feet a day at the following conditions: Base pressure, 14.65 pounds absolute (4 ounces); base and flowing temperature, 60° F.; specific gravity, 0.60.

D = actual internal diameter of pipe in inches.

L = length of line in miles from point where upstream pressure is obtained to point where downstream pressure is obtained.

P_u = upstream or inlet pressure in pounds per square inch absolute, being equal to the gauge pressure plus the atmospheric pressure.

P_d = downstream or outlet pressure in pounds per square inch absolute, being equal to the gauge pressure plus the atmospheric pressure.

Weymouth's formula is presented here for readier comparison with those appearing in the third period. It may also be proper to show here the formula devised

Inspection group, Roane County, W. Va., Field in 1915. Left to right: John B. Corrin, second man unidentified, W. Y. Cartwright, J. G. Pew, A. C. Bedford and T. O. Sullivan

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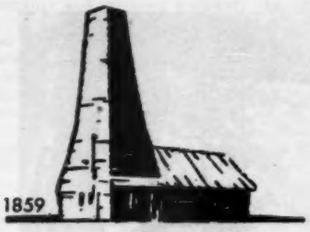

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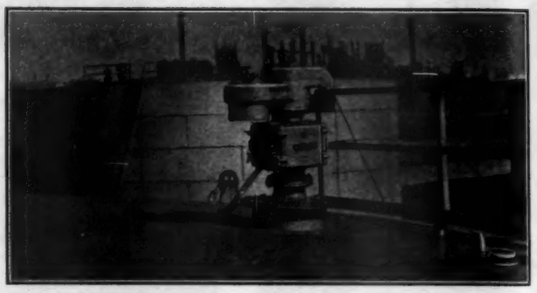

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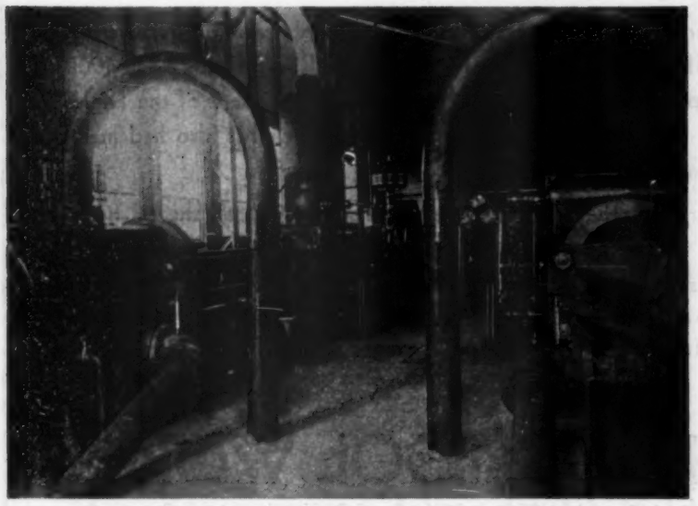
by Weymouth for computing the power requirements for compressing gas:

$$\text{I.H.P.} = \frac{4.44 - 106.6 \log r}{0.97 - 0.0306\ r}$$

where

r = the ratio of absolute discharge pressure to absolute suction pressure.

The Pitot tube was first described in 1732 by its inventor, Henri Pitot, who stated that it followed the principle of the law of falling bodies, that is, $v^2 = 2gh$. In 1850 D'Arcy adapted it to closed pipe flows by the addition to the bent (Pitot) tube of a static pressure tube, and it was found that the difference in height of liquid in the two columns of a U-gauge connected to the dynamic and static tips of the tube respectively, gave a true measure of the velocity of flowing liquids. In 1873 Prof. S. W. Robinson applied the Pitot tube to the measurement of gases. The general formula for the Pitot tube and the orifice are identical.



Interior of natural gas compressor station operating in West Virginia, 1911

Gas Production Records

Gas production records on a basis of cubic feet began in 1906, and may be traced to 1919 as follows: Arkansas in 1916 produced 2,388,000,000 feet, and in the following year went to 5,610,000,000 feet to hold to this level through 1919. California in 1906 produced 153,000,000 feet, and its output rose steadily to 1917 when it reached 49,427,000,000 feet. Production in 1918 dropped to 39,719,000,000 feet and rose to 55,607,000,000 feet in 1919. Illinois' output in 1906 was 410,000,000 feet, and rose to 8,473,000,000 feet in 1909, after which there was a steady decline ending in 1915 when 2,690,000,000 feet were produced. A second decline set in in 1919 and continues today. Indiana in 1906 produced 7,861,000,000 feet of gas and this output has fallen steadily since 1909. In 1919 Indiana production had fallen to 1,407,000,000 feet. Kansas produced 69,323,000,000 feet of gas in 1906, and reached its peak in 1908 when 80,740,000,000 feet were produced. In 1919 output had fallen to 16,150,000,000 feet.

Kentucky gas output in 1906 was 789,000,000 feet, and through the remainder of the period averaged close to 2,000,000,000 feet a year. Separate statistics for Louisiana begin in 1915 when 25,540,000,000 feet were produced. In 1919 output had reached 47,062,000,000 feet. Montana production in 1915 was 6,000,000 feet and in 1919 jumped from 177,000,000 feet to 858,000,000 feet. New York produced 2,548,000,000 feet in 1906 and moved up with few declines to an output of 8,124,000,000 feet in 1919. Ohio production in 1906 was 45,436,000,000 feet and reached a peak of 79,510,000,000 feet in 1915 after numerous fluctuations. Production in 1919 had fallen to 63,153,000,000 feet.

Oklahoma in 1906 produced 3,520,000,000 feet of gas and output advanced steadily until 1917 when it reached 137,384,000,000 feet. In 1918 there was a drop to 124,317,000,000 feet, and in 1919 output rose to 163,649,000,000 feet. Pennsylvania held well over the 100,000,000,000 mark throughout the period. Pennsylvania production in 1906 was 138,161,000,000 feet and the decline which followed was almost unbroken until 1915 when the output was 113,692,000,000 feet. In 1916 production rose to 130,484,000,000 feet and a second decline set in. Output in 1919 was 113,489,000,000 feet.

Texas gas production until 1911 was included in the government figures for Alabama and Louisiana. In 1911 Texas gas production was 5,503,000,000 feet and this output rose almost steadily until it reached 17,047,000,000 feet in 1917. There was a drop to 13,440,000,000 feet in 1918, and a rise to 24,710,000,000 feet in 1919. West Virginia in 1906 produced 119,400,000,000 feet and reached its peak in 1917 at 308,617,000,000 feet. In 1919 output was down to 234,095,000,000 feet. Wyoming produced 4,339,000,000 feet in 1918 and 6,014,000,000 feet in 1919. Value of the gas marketed from 1906 to 1919 rose steadily from $46,874,000 in 1906 to $160,888,000 in 1919. The average price per thousand feet advanced without a break from 12.1 cents in 1906 to 21.6 cents in 1919.

Uses of Natural Gas

It is interesting to note the uses to which natural gas was put in 1905. Establishments and equipment supplied numbered as follows: Iron mills, 81; steel works, 90; glass works, 257; brick plants, 153; other establishments, 7,988; gas engines, 2,794; compressors, 99. There were reported 2,139 gas companies which listed 779,638 domestic gas consumers as well.

It was in this period that the valuable element helium was discovered to be present in natural gas. The spectroscope revealed the presence of helium in the sun in 1868, and in 1894 Sir William Ramsay discovered terrestrial helium while heating cleveite and sparking the gas evolved with oxygen in the presence of caustic soda. The residual gas was found to be helium. H. Kayser in 1895 discovered the presence of helium in the atmosphere.

H. P. Cady and D. F. Macfarlane in 1907 discovered the presence of helium in natural gas from wells in Kansas, but little was done in developing this field until the United States entered the World War in 1917, when sufficient helium to fill a dirigible would have cost three million dollars. In isolating helium from natural gas the Dewar method was used originally. The gas is passed over charcoal, cooled to the temperature of liquid air, and under these conditions the helium alone escapes adsorption. Neon and hydrogen are separated from helium by lowering temperature to condense the neon and by adding oxygen and sparking to form water with the hydrogen. In the latter method, used in the government plant built at Fort Worth, Tex., in 1925, extraction is accomplished by liquefaction of the natural gas and fractional separation.

Discoveries and events of particular interest in the natural gas field during this period may be listed as follows:

In 1905 the Caddo gas pool was discovered while drilling for oil. The wells were abandoned as gassers, as were those drilled in 1909. The wells were allowed to blow in the hope that oil would follow as the gas was found to be unusually "wet." The Glenn Pool was opened in 1906; the Cushing Pool in 1912; the Healdton and Loco Pools in 1913, and the gas pools in McIntosh, Coal, Hughes and Latimer Counties in Oklahoma in 1915. The Hogshooter gas pool in Oklahoma was discovered in 1907. It is estimated that 250,000,000,000 feet of gas were wasted in the development of the Cushing Field. Other Oklahoma pools opened and the dates were: Blackwell, 1914; Duncan, 1912; Walters, Fox and Graham, 1919.

Development in Texas

The first important supply of natural gas in Texas was from wells at Petrolia, in the north central area, in 1907. Gas from these wells was piped to Fort Worth in 1909. Natural gas was discovered in the Panhandle in December of 1918. In 1909-10 large gassers in Buena Vista Hills, Calif., were completed and piped 40 miles to Bakersfield. In April, 1913, natural gas from these wells was turned into the distribution system of Los Angeles, for a 12-inch pipe line 120 miles in length.

In 1905 natural gas was piped to Kansas City, Kans., Topeka, Lawrence, Leavenworth, and to Joplin, Mo. In the following year Atchison, Kansas City, Mo., and St. Joseph, Mo., were supplied with natural gas. The records show that many gas companies were consolidated in 1905 in Kansas.

In October of 1917, natural gas was discovered in the shallow sands of the famous Tioga Field in Pennsylvania. In this same year Peoples Natural Gas Co. abandoned a test that had been drilling since 1911 at a depth of 7,248 feet on the Candor dome 5 miles northeast of McDonald in Washington County. At the close of the fourth period the natural gas fields of West Virginia were distributed over 32 counties in the following sands: Second Cow Run, Salt Maxson, Big Lime, Big Injun, Berea and Gordon. The natural gas fields of Ohio were distributed over 50 counties, lying in the eastern half and the northwestern quarter of the state, production being chiefly from the Clinton sand in the central gas belt, and from the Trenton limestone in the northwestern section. Cuyahoga County came into prominence in 1914. The natural gas fields of Kentucky were found mainly in the eastern third of the state in the "Corniferous" limestone, "Beaver Creek" sand, "Waverly" formation, and Big Injun. Twenty-three counties in the eastern third of Kansas produced gas on a commercial scale.

The earliest recorded use of natural gas on a commercial scale in Oklahoma was at Red Fork, Tulsa County, in 1902. In the following year it was used for drilling near Lawton, Pawhuska and Newkirk. In 1904, the beginning of the fourth period, natural gas was distributed to domestic consumers in Tulsa, Bartlesville, Ochelata, Pawhuska and Red Fork. Near the close of the period natural gas was produced profitably in 31 counties in the eastern half of the state. In 1917 Lone Star Gas Co. extended its mains northward from Texas to connect with the new Oklahoma supply. Arkansas development featured the discovery of the Kibler Field in 1915. In 1917 two large gassers were completed 50 miles southwest of New Orleans, La. In 1916 the gas field in Moorehouse Parish was discovered, the first well being credited with a capacity of 5,000,000 feet a day and pressure of 800 pounds at a depth of 2,200 feet.

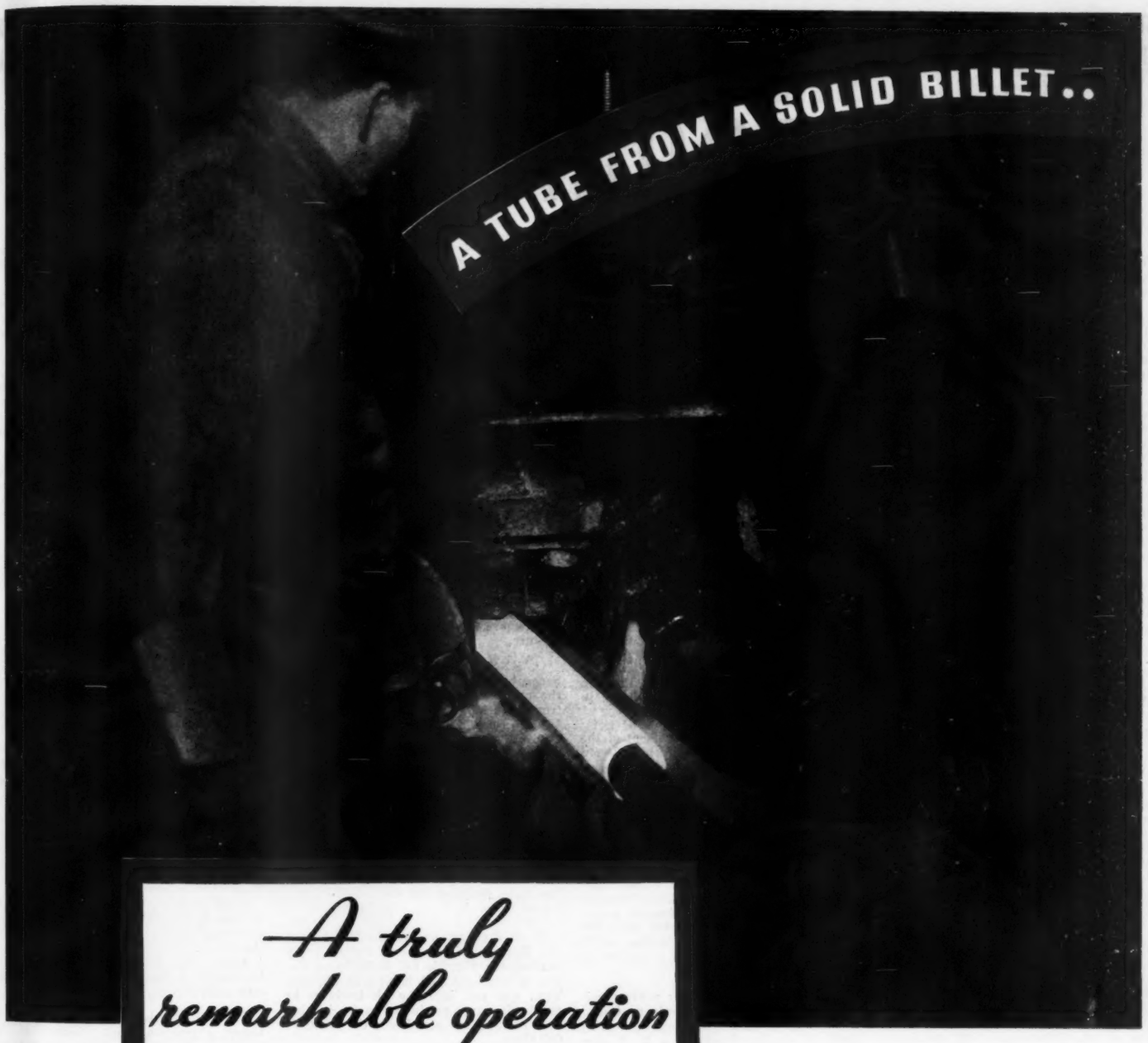
Hauling machinery for natural gas compressor station in Kentucky

McKeesport Field

One of the most interesting developments of natural gas in the fourth era was the McKeesport Pool, just south of McKeesport, Pa., located 15 miles southeast of Pittsburgh.

The first well in this pool was completed on August 29, 1919, in the Speechley sand. It made 4,000,000 feet of gas per day and started an intensive play that resulted in an output of about 71,530,000 feet by November 10, 1919, when the peak of production was reached.

Observers familiar with this field have stated that the play cost the public $30,000,000 and the gas recovered did not bring more than $3,000,000. The pool was barely a mile square and the area greatly overdeveloped, and it is therefore safe to state that many speculators suffered heavy financial losses which might have been avoided if the warnings of the geologists had been heeded.



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PERSONALITIES

Robert G. Stewart, president of the Pan American Foreign Corp., began as a salesman for the Standard Oil Co. (Indiana) in Minneapolis, Minn., in 1915.

Russell S. McFarland, vice president in charge of Texas operations of the Texas Seaboard Oil Co., entered the oil business in 1917 as a geologist for the Empire Gas & Fuel Co.

John M. Lovejoy, for years vice president of the Amerada Petroleum Corp., and later president of the Seaboard Oil Co. of Delaware, went to work in the Electra fields of Texas as a roustabout in 1915.

Daniel J. Moran, president of the Continental Oil Co., was a telegraph operator, pumper, gauger, and connection foreman in Oklahoma for the Texas Co., starting in 1908.

William C. McDuffie, receiver for the Richfield Oil Co., California, began as a laborer on a pipe line gang in 1911 and later was a rotary driller.

George Coyle, many years a director and general superintendent of the Prairie Pipe Line Co., started his career in Olean, N. Y., as a bookkeeper in the office of Capt. N. V. V. Franchot. Then he took to pipe lining, and got to the top of his profession.

James Matthews, of Bradford, Pa., producer, pipe liner, refiner, casinghead gasoline manufacturer and marketer, started as a Western Union messenger boy at the age of 12. He was a telegraph operator for the Eureka Pipe Line and later the National Transit Co. He decided the oil business was big enough to accommodate another fellow, and he went out and succeeded in every branch of it.

L. P. St. Clair, president of the Union Oil Co., California, was manager of the Bakersfield Gas & Electric Co. when a young man, but a salaried job didn't suit him and he went into the Kern River Field about 25 years ago and successfully explored for oil. He has been president of the Independent Oil Producers Agency for 23 years.

E. W. Clark, who was chairman of the board of the Union Oil Co., California, and president of the American Petroleum Institute, started in as a pipe line man. He was given the position of manager of the Producers Pipe Line in California in 1910.

Edward L. Doheny, noted California and Mexican operator, and oil executive, was a miner for years before he became interested in the signs of oil around Los Angeles, Calif. He became a pioneer fuel oil man and his company's No. 4 Cerro Azul well in Mexico was one of the largest flowing wells in the world.

R. W. Gallagher, director of the Standard Oil Co. of New Jersey, and in 1934 made head of all the Standard's gas interests, was a gauger for the New York Transit Co. before going into the natural gas end of the industry. He started at the bottom in gas, and his all-around ability sent him to the top while yet a young man.

Henry L. Phillips, president of the Sinclair Prairie Oil Co., when a high school boy in Wooster, Ohio, found time to run a newspaper agency and a laundry agency and to run errands in his father's dry goods store. This was job enough for one boy, but he graduated, on top of it all, and finally became a lawyer. He went from the Sinclair legal department into executive positions.

Robert S. Ellison, president of the Stanolind Crude Oil Purchasing Co., and the Stanolind Pipe Line Co., entered the legal department of the Midwest Refining Co. at Casper in 1916, his first oil experience.

A. W. Ambrose, vice president of the Cities Service Gas Co., began with the Shell Oil Co. of California as a geologist in 1914.

Clarence H. Lieb, president of the Carter Oil Co., entered the oil business in 1917 as a draftsman for the old Carter Oil Co., in the Eastern fields. He did so well that when a good man was needed to go to the Mexican fields, Mr. Lieb was chosen. His foreign oil experience was long and valuable.

Bernard L. Majewski, vice president of the Deep Rock Oil Corp., and a noted marketer, started as an office boy with Standard Asphalt & Refining Co. in 1908.

George W. Strake, discoverer of the Conroe Field in Texas, entered the oil business in the employ of the Mexican Gulf Oil Co., in the Tampico district, in 1919.

James A. Moffett, vice president of the Standard Oil Co. of California, began with the Vacuum Oil Co. in 1906 as a junior clerk in the sales department. President Franklin D. Roosevelt appointed Mr. Moffett as housing administrator in the campaign of industrial recovery, to which position he gives much, if not all, of his attention.

T. B. Slick, at times the largest individual oil producer in the United States, drove teams and worked around leases when a youth, and was a lease buyer for C. B. Shaffer when the Cushing Field opened in 1912. He was a native of Clarion, Pa.

Everett Lee DeGolyer, for years president of the Amerada Petroleum Corp., started his notable geological career in 1906 as a camp hand for a U. S. Geological Survey party while still a student in the Oklahoma University. After graduation he worked for the Government and then for the Mexican Eagle Oil Co. in Mexico where he scored a great professional success.

A. M. Donoghue, vice president of the Texas Pipe Line Co., started with the Oil Well Supply Co. in its Bradford, Pa., offices as soon as he was through school, but left the supply business to join the Texas Co. at Beaumont, Tex., in 1903.

J. S. Abercrombie, head of J. S. Abercrombie Co., of Texas, began as a roustabout on his uncle, Charles Abercrombie's leases in the Humble Field in 1908.

Mills Bennett, president of the Mills Bennett Production Co. and Liberty Pipe Line Co., Texas, had his first experience with the Vinton Pipe Line Co. in Louisiana in 1911. He became manager of that company.

Burt E. Hull, president of the Texas Pipe Line Co., worked on the construction of the Texas Pipe Line from Humble to Sour Lake in 1905.

Wallace E. Pratt, vice president of the Humble Oil & Refining Co., made a survey of the oil and gas reserves of Kansas in 1908 and then went into mining engineering. He returned to oil in 1912 with the East Asiatic Petroleum Co. in the Far East.

James Anderson, vice president of the Humble Oil & Refining Co., first worked on a pipe line gang in the Illinois fields for the Ohio Oil Co.

John R. Suman, vice president of the Humble Oil & Refining Co., began as a geologist for the Rio Bravo Oil Co. in Texas in 1912.

James Hutcheson, vice president and general manager of the Rio Bravo Oil Co., had his first oil experience in California. He was with the Kern Trading & Oil Co. (fuel department of the Southern Pacific Railway) in 1907. In the following year he moved to the Associated Oil Co., where he got his first direct connection with field operations.

Harry C. Wiess, vice president of the Humble Oil & Refining Co., went to college from Beaumont, Tex., and in 1909 returned from the university and organized the Paraffine Oil Co., his first oil venture.

O. R. Seagraves, head of the Moody-Seagraves interests, was initiated into the natural gas business in 1924 in gas transportation and distribution in the White Point Field, Texas, and Corpus Christi.

T. F. Rothwell, president of the Yount Lee Oil Co., Beaumont, Tex., was first a mule skinner in the West Virginia fields in 1905, later joining the South Penn Oil Co. as a tool dresser.

J. F. Bashara, Bashara Oil Co., and D. & L. Production Co., decided in 1914 to get into the oil business and organized the Lake Graham Oil Co. to drill on a 5-acre lease.

R. S. Sterling, one of the founders of the Humble Oil Co., and former president of the Humble Oil & Refining Co., was a merchant and banker in Humble, Tex., and got into the oil business by purchasing two producing wells in that field in 1910. He now heads the Miramar Oil Corp.

T. E. Swigart, vice president of the Shell Petroleum Corp., Houston, Tex., went to work for the Shell organization in 1917, soon after he graduated from Leland Stanford University.

John J. McGoldrick, president of the Texas Pipe Line Co. of Oklahoma, was a line walker and pump station man for the Manhattan Oil Co., in Bowling Green, Ohio, in 1898.

Wirt Franklin, president of the Wirt Franklin Petroleum Corp., was practicing law in Ardmore, Okla., when he decided to block out some leases in that absolutely wildcat territory. Roy Johnson, a local newspaper man, was doing the same. They pooled their blocks and induced W. S. Critchlow to drill a well for an interest. They opened the famous Healdton Pool and all got rich.

James A. Gardner, president of the Gardner Petroleum Co., graduated as a geologist and came into the oil business from mining. Mr. Gardner was one of those occasional geologists who "play their own stuff" and he became a successful producer.

Julius Fohs, noted geologist and wildcatter, when he was 16 years old, made a report on mineral properties in Kentucky for a Cleveland company and at 17 the company put him in charge of its development of lead, zinc and spar mines. He came into the oil business in 1912 at the age of 22.

Oscar Wolf, chief engineer of the Texas Pipe Line Co., had his early experience with the Cumberland Pipe Line Co. in the Kentucky fields.

H. V. Foster, president of the Indian Territory Illuminating Oil Co., has been in the oil business ever since his father, the late Henry Foster, was granted a blanket lease on the Osage Nation by the Indians in 1895.

Burdette Blue, vice president of the Indian Territory Illuminating Oil Co., came into the oil business from the law. He practiced his profession for years in Bartlesville, Okla.

C. C. Herndon, vice president of Shelly Oil Co., was a practicing lawyer in Chickasha, Okla., before joining the Shelly Oil Co. 14 years ago.

H. L. Hunt, one of the largest independent producers in the East Texas Field and the Urania Field, Louisiana, and president of the Hunt Production Co. and Panola Pipe Line Co., left the cotton planting business to get into oil. He first operated in Arkansas following the opening of the El Dorado Pool.

R. W. Howe, vice president of the Atlantic Pipe Line Co., went to work for the Tuscarora Pipe Line Co., running a pipe machine in 1908.

J. Howard Pew, president of the Sun Oil Co., started in the company's refinery at Marcus Hook, Pa., and in 1913 succeeded his father at the head of the company, upon the latter's death.

J. Edgar Pew, executive vice president of the Sun Oil Co., began his oil and gas experience under J. N. Pew, Jr., for the Pittsburgh Gas Co. Then he was assistant to his brother, Robert, who was in charge of the Toledo refinery of the Sun company.

Capt. J. F. Lucey, president of the Lucey Petroleum Corp., began his oil career in Bakersfield, Calif., in 1900 as a producer, later entering the manufacturing business with the Bunting Oil Works at Coalinga in 1905.

E. A. Landreth, president of the Landreth Production Co. (Texas), went from Joplin, Mo., to the new Ranger Field in 1918 and at once got into the oil business, first in leases and royalties. He sold the famous "Landreth strip" in the Church Field Pool in Crane County to the Texas Co. for $6,500,000.

J. D. Collett, oil producer, Fort Worth, Tex., president of the General Mid-Continent Oil and Gas Association, entered the oil business at Spindletop, Tex., in 1901.

Clyde H. Alexander, independent oil man, but for years an official of the Phillips Petroleum Co., began his oil experience driving a lease team in Venango County, Pennsylvania, at the age of 13.

F. L. Chase, vice president and general manager of the Lone Star Gas Co., came into the gas business as a consulting engineer in New York and Columbus, Ohio. He joined the Lone Star in 1917.

Fred M. Lege, Jr., vice president and director of the Magnolia Petroleum Co., was first a natural gas man. He was general manager of the Galveston Gas Co. in 1908 and made president of the

HAYNES STELLITE COMPANY

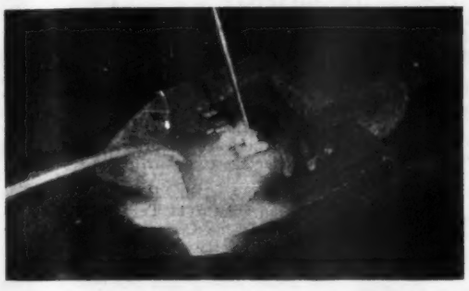
pioneers Hard-Facing in the Oil Fields

● These figures, reported by a large operator, represent average practice in the number of bits used per well drilled at Pierce Junction, Texas, and illustrate the rapid progress made since the introduction of Haynes Stellite as the first hard-facing material used by the oil industry. All wells were drilled to the same depth (3600 ft.) and through the same formations.

Prior to 1924—84 BITS PER WELL
–shop dressed and tempered steel bits.

1924 to 1928—44 BITS PER WELL
–hard-faced but not hard-set.

TODAY—14 BITS PER WELL
–hard-set with Haystellite Inserts and hard-faced with Haystellite Composite Rod.



● *Hard-Setting.* Present day practice is to hard-set the cutting and reaming edges of the bit with inserts of Haystellite, the cast tungsten carbide. The inserts are securely held in place with high test steel welding rod.

● *Hard-Facing.* The hard-set areas are then covered with a coating of Haystellite Composite Rod, particles of crushed Haystellite held in a suitable binder, which prevents the sections between the inserts from wearing away rapidly.

● *Result.* Bits set and faced with Haystellite Inserts and Haystellite Composite Rod form a fingered cutting edge, the ideal edge for efficient drilling. Such tools make fast, straight, out-to-gauge hole with long life between round trips.

HAYSTELLITE TRADE MARK

The Cast Tungsten Carbide diamond substitute made under processes protected by U. S. Patents.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

THE oil industry is this year celebrating its 75th anniversary—seventy-five years of notable progress and achievement. Haynes Stellite Company, the pioneers of the hard-facing process take considerable pride in their contributions to the development and progress of the industry.

First Bits Haynes Stellited in 1924

Hard-facing was introduced in the oil fields by the Haynes Stellite Company when the first fishtail bit was hard-faced with Haynes Stellite in California in 1924. The first run resulted in such an amazing increase in life over shop-dressed and tempered bits that drillers began to demand not only Haynes Stellited fishtail bits and other types of drilling tools, but also equipment that would be capable of making full use of the remarkably long life of the new hard-faced tools.

Thus began a decade that has made drilling history. Haynes Stellite Company have constantly led the way in development of better hard-facing materials—first, with the introduction of Haynes Stellite, a cobalt-chromium-tungsten alloy, and later with Haystellite, a cast tungsten-carbide diamond-substitute, and Haystellite Composite Rod, consisting of particles of crushed Haystellite uniformly distributed in a suitable binder of high test steel.

Haystellite, The Diamond Substitute, Introduced in 1928

In 1928 Haystellite Inserts were introduced for hard-setting oil well drilling tools, and immediately all previous drilling records were surpassed. It was standard practice at that time to tie in Haystellite Inserts with a high strength steel rod and then cover the hard-set face of the bit with Haynes Stellite.

Haystellite Composite Rod Introduced in 1930

In 1930 the introduction of Haystellite Composite Rod for use as the final facing on the bit resulted in longer life of drilling tools and still further drilling economies. Today there are seven sizes of Haystellite Inserts and twenty-six types of Haystellite Composite Rod—an insert and a composite rod for every purpose. These products are used in every oil field in the world.

Faster Drilling Speeds Have Followed Each Haynes Stellite Development

A glance at the figures on the left will show the remarkable progress made during the ten years since the introduction of hard-facing to the oil industry. Drilling tools hard-faced and hard-set with Haystellite Inserts and Haystellite Composite Rod make fast, straight and "out-to-gauge" hole with fewer round trips.

Careful and thorough research investigations by Haynes Stellite Company and Union Carbide and Carbon Research Laboratories, Inc., combined with the practical field work conducted by Haynes Stellite Company have already saved thousands of dollars for the oil industry. This service will be continued for the purpose of ever increasing the efficiency and economy of many operations in the industry.

New Booklet Describes Modern Practice

A new 36-page booklet, "Haynes Stellite Products in the Oil Fields," describes the latest methods and materials for hard-setting and hard-facing oil well drilling tools and wearing surfaces of other equipment. This valuable booklet reviews briefly the history of hard-facing in the oil fields followed by detailed procedures for the application of hard-setting and hard-facing materials. There are also included over forty illustrations of various types of modern oil well drilling tools on which Haynes Stellite Products are adaptable. Copies of this booklet may be obtained from Haynes Stellite Sales Offices located in Chicago, Cleveland, Detroit, Houston, Los Angeles, New York, San Francisco and Tulsa, or from the General Office and Works at Kokomo, Ind., or Foreign Sales Department, New York City.

Information on Haynes Stellite Products also is available through the 42 apparatus shipping points of The Linde Air Products Company.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

1914-1934—Twenty Years of Progress

PRATT . . ANDERSON . . SUMAN . . HUTCHESON . . WIESS . . SEAGRAVES . . ROTHWELL . . BASHARA . . STERLING . . SWIGART . . McGOLDRICK
FRANKLIN . . FOHS . . WOLF . . FOSTER . . BLUE . . HERNDON . . HUNT . . HOWE . . PEW . . LUCEY . . LANDRETH . . COLLETT . . ALEXANDER
CHASE . . LEGE . . FILLEY . . TEAGLE . . MACKIE . . MABEE . . CHILDS . . McMAHON . . WENTZ . . TOWL . . DAWES . . CONNELLY . . MARLAND

North Texas Gas Co., now the Lone Star Gas Co., in 1914.

Everett R. Filley, manager of the Oklahoma-Kansas division of the Texas Co., upon leaving college got a job as a roustabout for the Producers Oil Co., a subsidiary of the Texas Co.

Walter C. Teagle, president of the Standard Oil Co. (New Jersey), after graduating from Cornell University, entered the offices of Schofield, Shurmer & Teagle, in Cleveland, Ohio, where he was given an all-around training in the oil business. About 1903 he joined the Standard Oil Co. in its export department.

Robert A. Mackie, president of the Bradford Supply Co., began to sell oil field supplies in the store and in the field 54 years ago. Twenty-seven years ago he and other supply salesmen organized the Bradford Supply Co., and it was a success from the start.

J. E. Mabee, president of Mabee Consolidated Corp., and one of the most successful of the recent entrants into the production of oil, started as a dealer in horses and mules.

W. L. Childs, president and general manager of the Reed Roller Bit Co., Houston, Tex., entered the oil industry in 1907 having been with the Southern Pacific Railroad. His first connection was with the Gulf Pipe Line Co., and in 1917 he went with the Hughes Tool Co., and in 1925 with the Reed Roller Bit Co.

Charles L. McMahon, prominent Mid-Continent producer, went to work for the South Penn Oil Co. as soon as he finished school. He became an oil producer in West Virginia in 1900. Just now his main interest is his East Texas properties.

L. H. Wentz, sole owner of the Wentz Oil Corp., came to Oklahoma from Pittsburgh 25 years ago when Kay County began to look like an oil country. His most notable success was in the Tonkawa Field where he built up a large fortune.

Forrest M. Towl, president of the southern group of pipe lines, was a graduate civil engineer whose first work in the oil industry was surveying for pipe lines from 1879 to 1886 when he was made assistant engineer by the National Transit Co., and later chief engineer.

Henry M. Dawes, president of Pure Oil Co., became president of the South Petroleum Co. in the Marietta, Ohio, Field before he was 30. Companies in which he was interested were among the pioneers in the Louisiana Field.

W. L. Connelly, chairman of the board of the Sinclair Prairie Oil Co., spent his early boyhood in the Pennsylvania oil fields, but at the age of 20 he owned producing properties at six different points in the Wood County, Ohio, Field.

E. W. Marland, for years head of the Marland Oil & Refining Co., came to Oklahoma in December, 1908, with just enough money to pay his board for a month, and with a letter of credit to a supply company. He drilled a well on the 101 Ranch in Kay County for a share in the property and opened the Ponca City oil field.

Rush Greenslade, vice president and general manager of the Gypsy Oil Co. and Gulf Pipe Line Co. of Oklahoma, got his first lesson in pipe lining as an office boy in the Buckeye Pipe Line offices in Lima, Ohio. He joined the Gypsy Oil Co.'s legal department in 1914.

W. S. Fitzpatrick, vice chairman of the executive committee of the Consolidated Oil Corp., was an attorney, public man and oil producer in Kansas when the late James E. O'Neil induced him to become counsel for the Prairie Oil & Gas Co. of which later he became chairman of the board.

Dana Kelsey, vice president of Sinclair Prairie Oil Co., came into the oil business from the Indian Service. He joined the Prairie Oil & Gas Co.'s land department and became vice president and general manager.

Max Westheimer of Ardmore, Okla., was in the mercantile business with Westheimer & Daube, and the firm was also a large land owner in southern Oklahoma when the Healdton Field was opened, and the firm became widely known as producers and wildcatters.

James A. Veasey, vice president and chief counsel for the Carter Oil Co., entered the oil business from a lucrative law practice in Bartlesville and Tulsa.

C. B. Ames, president of the Texas Corp., was a prominent attorney before he entered the service of the Texas Co. in the capacity of counsel.

Ralph B. Pringle, vice president of the Tide Water Oil Co., was born on his father's oil lease in the Parker's Landing Field in Pennsylvania, and helped work on wells when a lad in his teens. His first employment with another producer was with the T. W. Phillips Gas & Oil Co., Butler, Pa.

P. M. Miskell, manager of refineries, Empire Oil & Refining Co., entered the oil business in the Bradford Field in Pennsylvania in 1907 in pipe line construction.

John B. Tonkin, vice president and general manager of the Peoples Natural Gas Co., took a school vacation job at the age of 16 as a water boy for a crew of workmen engaged in stopping leaks in a gas line in Toledo, Ohio. When school days were ended he went with the River Gas Co.

E. J. Nicklos, vice president of the Continental Oil Co., was initiated in oil as a roustabout in the Petrolia, Ontario, Field in 1895.

Walter Miller, vice president of the Continental Oil Co., began his oil experience in the Tide Water Oil Co.'s refinery at Bayonne, N. J., as yield clerk in 1909.

Frank O. Prior, president of the Stanolind Oil & Gas Co., started in 1919 as a laborer at Midwest, Wyo., in the Salt Creek gas plant of the Midwest Refining Co.

William G. Heltzel, general superintendent of the Stanolind Pipe Line Co., after graduating from Carnegie Institute of Technology, Pittsburgh, Pa., was put on a pipe line gang of the Sinclair Pipe Line Co. by John R. Manion, president, and supplemented his technical education with practical work from the bottom up.

B. P. Sibole, vice president and director of the Stanolind Pipe Line Co., left the Pierce Arrow Co. in 1920 to take charge of the motor transport department of the Sinclair Pipe Line Co. and went with Stanolind when the Standard Oil Co. (Indiana) purchased control of the Sinclair company.

J. F. Darby, president of the Darby Petroleum Corp., had had no previous oil experience when he went into operating in Kansas in 1919 and became a producer, later incorporating his holdings.

George D. Locke, vice president of Barnsdall Refineries, Inc., had a varied business experience before he entered the oil business in 1917 as vice president of the Bigheart Producing & Refining Co., which was later bought by the Barnsdall organization.

Samuel W. Meals, president of the Carnegie Natural Gas Co., at 19 years old, went to work in the Bolivar, N. Y., oil field as a roustabout at $1.50 per day.

H. D. McCracken, vice president of the Illinois Pipe Line Co., Fort Worth, Tex., entered the oil industry as oil dispatcher with the Indiana Pipe Line Co. at Chicago in 1892.

A. L. Derby, president of the Derby Oil & Refining Co., was a producer in the Kansas Field before he built his organization into a completely integrated company.

Jack Vickers, president of the Vickers Petroleum Co., was well known as a successful producer in Kansas before he extended his business to refining.

L. L. Marcell, chairman of the board of White Eagle Oil & Refining Co., began producing oil in the old eastern Kansas shallow fields before Kansas broke into the list of big producing states, and his business grew with the fields.

W. V. Hartman, vice president of the Gulf Refining Co., has been engaged in marketing work for that company for over 30 years.

G. H. Van Senden became associated with the Shell organization in 1912. At present he is located in New York in the capacity of vice president in charge of manufacturing for Shell Union Oil Corp.

Charles B. Buerger, vice president of the Gulf Refining Co., in charge of refining, has in a large measure been responsible for the great refining capacity and organization developed by that company.

Edward J. Bullock was moved to Chicago by the Standard Oil Co. in 1904 although he had started with the company 15 years earlier as an office boy in Milwaukee. Today he is vice president and director of the Standard Oil Co. (Indiana) and high in the councils of the industry.

Judge Amos L. Beaty, chairman of the Planning and Coordination Committee, is a product of Spindletop, having joined the Texas Co. in those days in a legal capacity. Through successive steps he ultimately became chairman of the company in 1926. The next year he resigned and is now associated with the Phillips Petroleum Co. as director.

Col. Frank R. Coates became an oil man in 1913 although at the time he probably did not realize it. It was during this year that he joined the Henry L. Doherty organization through the latter's purchase of a utilities company in Toledo, Ohio.

A. G. Maguire was a pioneer filling station operator, having sensed the possibilities of this business in 1909. Today he is chairman of the board of the Wadhams Oil Co.

Paul G. Blazer, president of the Ashland Refining Co., Ashland, Ky., entered the oil business toward the end of the fourth era in Kentucky, doing pipe line work.

G. Harrison Smith, president of Imperial Oil, Ltd., has had wide experience and various positions of responsibility during his long connection with Standard Oil Co. (New Jersey).

D. A. Little, president of the Magnolia Petroleum Co., has been in the oil industry since 1914. He entered the employ of the Magnolia in his home town of Corsicana, Tex., at that time.

Fred T. Manley has been with the Texas Co. since its earliest days. He is the coinventor with R. C. Holmes of the cracking process which bears their names. In 1928 he became vice president of the Texas Co.

W. S. S. Rodgers joined the Texas Co., of which he is now president, in 1915, bringing with him much experience gained in the fields of California.

J. Roby Penn, recently elected president of the Texas Pacific Coal & Oil Co., went to work for the Ohio Oil Co. before the turn of the century. He was very active through the Central West under J. C. Donnell, serving as head of the land department. The position he recently resumed was one which he relinquished in 1928 to devote his time to private interests.

Herbert R. Gallagher, president of the Consolidated Oil Corp., entered the oil business early in this era with the Shell Oil Co. of California. For over 20 years his activities were confined to the Pacific Coast until he moved East for Consolidated in 1932.

Edward L. Shea, president of Tide Water Oil Co., graduated from Princeton University in 1916 and immediately went to work in Tide Water's Bayonne, N. J., refinery. He has also had practical experience in production and sales work for the company.

George A. Hill, Jr., president of the Houston Oil Co. of Texas and the Houston Pipe Line Co., entered the oil business during the fourth era as an attorney. He was born in Corsicana, educated in Texas schools and has been for years one of Houston's outstanding civic leaders.

Frederick H. Bedford, Jr., director of the specialty business of the Standard Oil Co. (New Jersey), began with the company in 1914 after his graduation from Amherst. His first position of importance was in Paris as assistant to Peter Hurll of the Bedford Petroleum Co.

Axtell J. Byles, president of the American Petroleum Institute and former president of the Tide Water Oil Co., was born in Titusville, Pa., and entered the oil business as an attorney.

C. O. Stillman, former president of Imperial Oil, Ltd., built the company's first refinery at Sarnia, Ontario, in 1897. His death early this year followed his retirement by just a few months.

A. M. McQueen, who before his retirement and death, had been vice president of Imperial Oil, Ltd., was an authority on production in Canadian and South American fields.

Col. J. F. Drake, president of the Gulf Oil Corp., entered the oil business in 1919 shortly after his military service was ended. His first position was in an executive capacity with Gulf.

R. Ogarrio, vice president of the Texas Co., came with the company in 1916 at Tampico as assistant engineer.

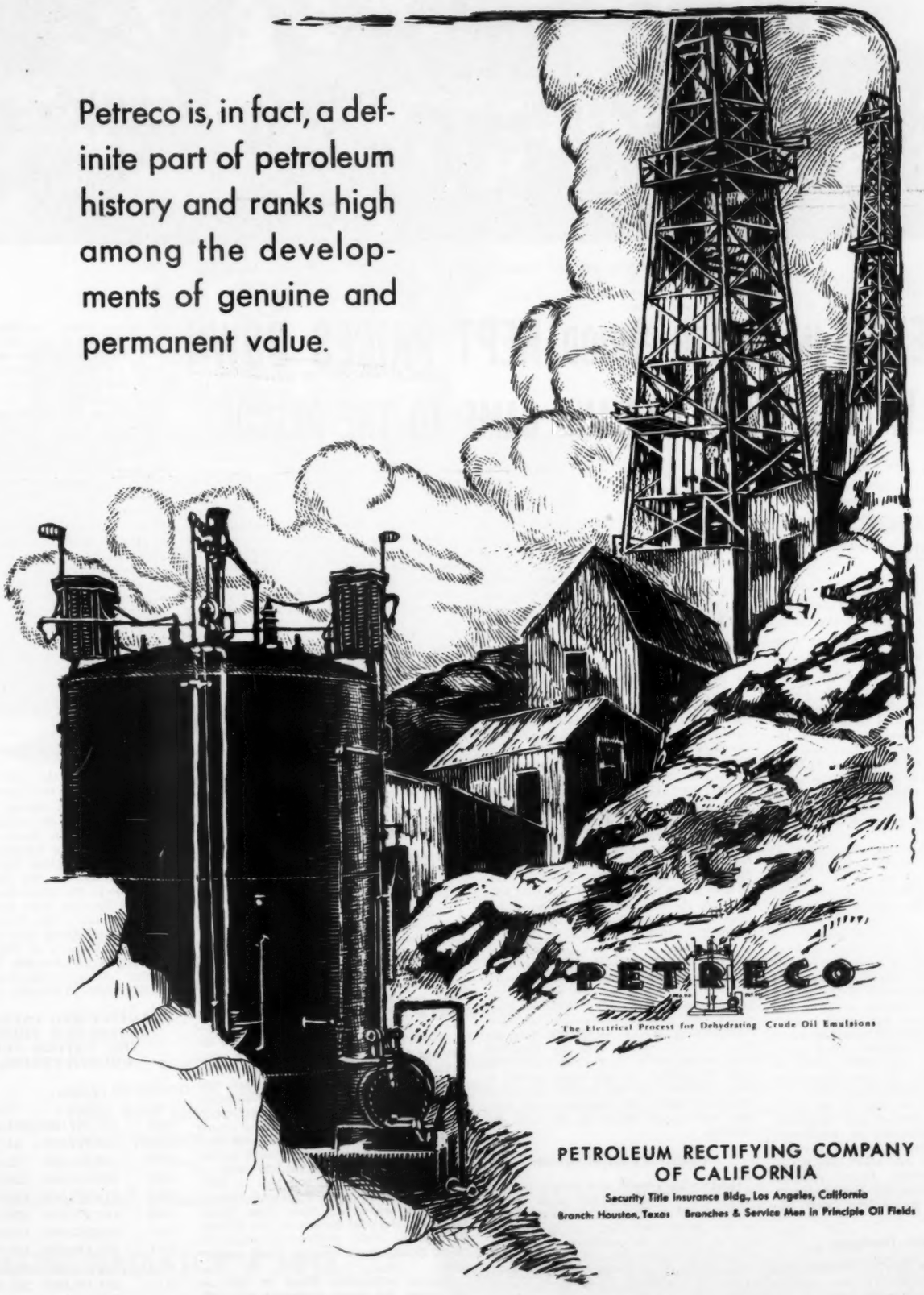
Thomas R. Weymouth is one of the best known natural gas men in the country. His inventions and writings have made him an outstanding authority. He is located in New York City with the Columbia Gas & Electric group.

William R. Boyd, Jr., widely known and able executive secretary of the American Petroleum Institute, has been a prominent figure in the industry since 1920.

T. H. Barton, president and treasurer of the Lion Oil Refining Co., was attracted to El Dorado, Ark., in 1921, by the opening of the field at that time.

A. W. Peake, vice president and director of the Standard Oil Co. (Indiana), entered the industry in 1912 with the Ventura Oil Co. in California.

James J. Cosgrove, general counsel for the Continental Oil Co., came into the oil business by joining the Texas Co.'s legal staff in 1922.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Outdoor auction sale of leases of the Osage nation at Pawhuska, Okla.

BIG FIELDS IN FOURTH PERIOD KEPT PRICES DOWN UNTIL WORLD WAR DEMAND CAME TO THE RESCUE

PRICES—ERA NUMBER 4 1904-1919

The crude oil price in the beginning of the fourth 15-year period of the oil industry started off in 1904 with an average for the year of 84 cents per barrel. It dropped to 62 cents in 1905 and to 61 cents in 1910 and 1911. It passed the dollar mark in 1916, influenced by the demand of the allied nations at war with the Triple Entente, and after the United States entered the European war the price rose to an average of $1.56 in 1917, and to $1.98 in 1918. The average price for the whole period was 97.7 cents per barrel for 3,346,350,000 bbls. of crude, the total value of which was $3,269,636,000.

It was a period of big production. It took 41 years to produce the first 1,000,000,000 bbls. of oil in the United States, but over 3,000,000,000 bbls. was produced in the 15 years of the fourth period.

The European war was a boon to the oil industry. Oil and its products were found to be absolutely essential in carrying on modern systems of warfare, and even though the production of the United States had reached figures it never had touched before, there was never enough to keep up with demand and the enormous stocks which had been piled up in the Cushing area were drawn upon to such an extent that the pipe lines were worked to their utmost capacity to get the oil to market. It was a period of pipe line building. Kansas and Oklahoma oil fields were connected by additional lines with Gulf Coastal ports and refineries; with Chicago and other lake ports, and with Mississippi River refining points, and lines from the Mid-Continent to their eastern connections were increased in number.

Great Fields Developed

Great fields were developed in this period. Illinois came into its own and its big pools in the southeastern part of the State rose to a peak of 33,686,000 bbls. in 1908. For six years this big field averaged more than 30,000,000 bbls. per year. From January 1, 1907, to December 31, 1912, the field produced 181,930,000 bbls. The field was made up of a number of pools most of which were located in Crawford, Clark and Lawrence Counties, and close to one another. For the biggest six years of the Illinois Field the State produced nearly 16 per cent of the total production of the United States. It was fortunate for the industry generally that the Glenn Pool a few miles south of Tulsa, in Oklahoma, opened in the fall of 1905, produced its greatest volume of oil in 1906 and 1907 at the same time that Illinois was pouring out its riches so prodigally. The Glenn Pool produced as high as 120,000 bbls. a day and had the largest flush production in the United States up to that time. Between the eastern Illinois pools and the Glenn Pool, and a steadily increasing production in California, the annual production of the United States rose from 117,081,000 bbls. in 1905 to 220,449,000 bbls. in 1911. Illinois began to decline after 1911 but production in the United States continued upward because of the tremendous growth of production in California, where crude oil output rose from 29,649,000 bbls. in 1904, the first year of the fourth period, to 97,532,000 bbls. in 1918, the last year of the period, and Oklahoma advanced from 139,000 bbls. in 1903 to 103,347,000 bbls. in 1908, or to an average of 381 bbls. per day to an average of 283,143 bbls. per day. Oklahoma's tremendous growth was brought about by the discovery and development of the wonderful Cushing-Shamrock Field which had a peak production variously estimated at 305,000 to 330,000 bbls. per day in April, 1916, and the Healdton Pool which had a peak close to 100,000 bbls. Production in the State spread to many counties and the annual output increased steadily. The decline of one field was more than made up by new discoveries.

California's Rapid Growth

California's growth was almost as rapid as that of Oklahoma, but much of the oil produced in the Pacific coastal fields in the period was low gravity fuel oil and its market was confined to the area west of the Rocky Mountains and to Pacific exportations. Among the great pools opened in the fourth period in California were Midway with a peak of over 100,000 bbls. a day in 1914, which has, coupled with the Sunset Pool, developed into the largest producing field in all America. Its peak year was in 1914 when it produced 37,479,228 bbls. Together with Sunset which reached its peak in the same year it produced 50,025,843 bbls. in 1914. The pools are usually classified as one field under the name of Midway-Sunset. The Coyote Pool in 1912, Montebello in 1917, Lost Hills-Belridge in 1910, and Whittier in 1912, were discoveries of the fourth period. Pools developed earlier which reached their productive peak in the fourth period were Kern River, opened in 1900, peak in 1904, 17,226,000 bbls.; McKittrick, opened in 1898, peak year 1909, 5,807,360 bbls.; Coalinga, opened in 1896, peak year 1912, 19,546,000 bbls.; Santa Maria, opened in 1902, peak year 1908, 8,699,350 bbls.; Fullerton, opened in 1896, peak year 1911, 7,081,165 bbls.

The Coyote Pool, a fourth-period discovery, opened in 1912 reached its peak in 1918 with 12,614,598 bbls. The Whittier Pool did not reach major proportions.

Kansas Among the Leaders

Kansas, the pioneer oil-producing State of the Mid-Continent, was only a small producer of oil up to the discovery of the great Butler County Field. Butler County was known as a gas-producing area but no one had had any success in prospecting for oil until a gas test drilled by one of the Doherty gas subsidiaries found oil in the Augusta area in 1914, and really opened the field with a big well in 1915. The county developed a large number of pools close to each other, one of which the Towanda Pool opened in 1917 was one of the richest ever developed in the United States in a small area. Wells of 10,000 bbls. and upward to 20,000 bbls. in initial production were brought in in this pool. The development of the field was done during a time of good market prices. The adjoining county of Greenwood also developed good sized pools before the end of the fourth period.

Kansas produced 45,451,000 bbls. in 1918, as against 2,823,000 bbls in 1915, and considerably over 40,000,000 bbls. of the 1918 production came from Butler County, otherwise known as the Eldorado-Augusta Field, ranking it among the great fields of all time in flush production.

Kansas outranked Texas in 1918 as the latter big State produced only 38,750,000 bbls. in that year.

In 1918 the United States produced 355,928,000 bbls. valued at $703,944,000, or an average of $1.98 per barrel.

High Prices Everywhere

The average price of crude in the Appalachian fields (including Kentucky) in 1918 was $3.70 per barrel. In the Lima and Indiana Fields the average was $2.31 per barrel. Illinois, $2.34 per barrel; Mid-Continent (Kansas, Oklahoma, North and Central Texas, and North Louisiana), $2.19 per barrel; Gulf Coast fields, $1.70 per barrel; Rocky Mountain fields, $1.44 per barrel; California, $1.22 per barrel. Pennsylvania Grade oil brought an average of $3.93 per barrel to the producers.

It was in the fourth period that the discovery was made in the Bradford Field in Pennsylvania that water in poorly plugged wells was being forced through the sands driving dormant oil ahead of it into producing wells and increasing their production. In 1914 the once great field was believed to be almost at its end. It was producing at the lowest quantity in 45 years. By the close of the period Bradford producers had taken advantage of the "flood," as it was called, and property values rose to high prices and the field began its upward rise in production which has not reached its new peak in 20 years of intensive new drilling and flooding.

Osage Sales

The first of the now famous Osage sales began in the fourth era. With Colonel Walters, shown in the accompanying picture, as auctioneer, oil leases on quarter-section tracts, in the Osage Indian Nation in Oklahoma, were auctioned to the highest bidders. The first sale of tracts in the Burbank district was made in the latter days of the fourth era and brought sums below $1,000 for a 160-acre tract. The field was opened in the fifth period and later sales saw leases on Burbank tracts of 160 acres sold for as high as $1,990,000, while quite a number of quarter-sections brought the Indians over $1,000,000 each.

QUANTITY AND VALUE OF CRUDE PETROLEUM PRODUCED IN THE UNITED STATES IN FOURTH PERIOD, 1904-18

Year	Quantity (Bbls.)	Value	Avg. per bbl.
1904 ..	117,081,000	$101,175,000	$.86
1905 ..	134,717,000	84,157,000	.62
1906 ..	126,494,000	92,445,000	.73
1907 ..	166,095,000	120,107,000	.72
1908 ..	178,527,000	129,079,000	.72
1909 ..	183,171,000	128,329,000	.70
1910 ..	209,557,000	127,900,000	.61
1911 ..	220,449,000	134,045,000	.61
1912 ..	222,935,000	164,213,000	.74
1913 ..	248,446,000	237,121,000	.95
1914 ..	265,763,000	214,125,000	.81
1915 ..	281,104,000	179,463,000	.64
1916 ..	300,767,000	330,900,000	1.10
1917 ..	335,316,000	522,635,000	1.56
1918 ..	355,928,000	703,944,000	1.98
	3,346,350,000	3,269,636,000	$.98

At Last!... THE OUTSTANDING MECHANICAL LUBRICATOR . . . THE NEW McCORD *Class "SF"*

The McCord Class "SF" Mechanical Lubricator has been made possible through accumulated experience and continuous scientific research on lubrication problems, over a period of 30 years. It is a new and highly efficient unit throughout, not an old one redesigned. The nicety of this design and ruggedness of its construction result in a reliable and regular performance that has not been previously approached.

Fundamentally, it consists of an oil container or reservoir carrying one or more independent pump units, which are actuated by motion transmitted through an operating shaft traversing the entire length of the container, and employing various types of drive. Pumps are of the vertical differential plunger type, with pump body of brass forging, for long life, and minimum wear. Plungers and allied working parts are fitted to an accuracy of 1/10 of 1/1000 of an inch. Equal care has been used in designing the exterior of the lubricator to insure compactness and smoothness of all parts and surfaces.

Your Lubricator Problem!

Whether you now have lubricators already operating on your machines, or contemplate the installation of new equipment, you will find it to your advantage to discuss things with the McCord Engineers. For more than 30 years they have intensively studied the problem of machine lubrication and the overcoming of friction. The accumulated experience of nearly two generations in the field is yours for the asking. McCord Engineers are friendly, helpful and able. They will take a sincere interest in any problem of mechanical lubrication you may lay before them, and will give you their best advice on the most economical means of meeting and overcoming it, entirely without cost or obligation to yourself.

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DETROIT

MICHIGAN, U. S. A.

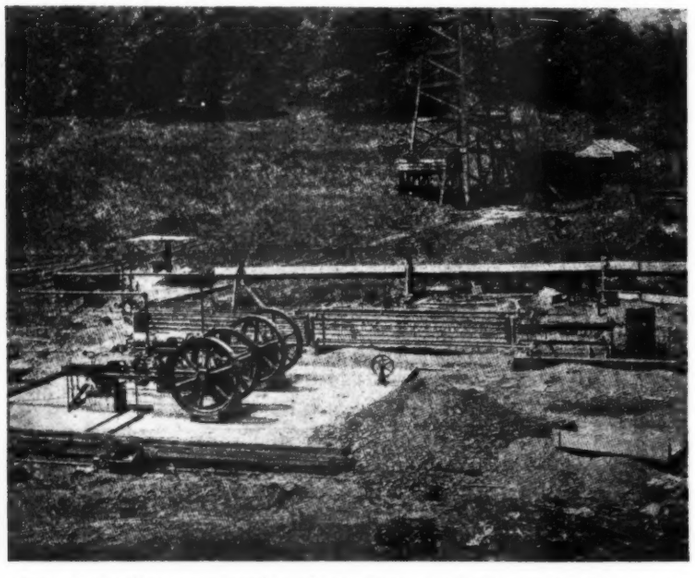
PUMPING GAS UNDER RIVER SUGGESTED DESIGN OF THE FIRST GASOLINE PLANT

NATURAL GASOLINE—1904-1919

Closely allied as it is with the natural gas industry and remembering that gas producing wells were drilled in China as early as 615 A.D., it may seem strange that the natural gasoline industry should have waited until the twentieth century for its beginning. The explanation lies in the fact that there was little need for such a product until then.

The natural gas that had been produced and transported long distances for household and commercial use as fuel and for lighting seldom contained a high concentration of recoverable gasoline vapors. Later, when gas supplies started coming from wells drilled principally for oil the quantity of recoverable liquid fractions became high and the volume large. Oil producers were faced with the problem of transporting the gas to market or utilizing all of it in their field operations, if it was not to be wasted.

Both practices called for pumping the gas at increasing pressures and in transporting casinghead gas from the oil wells of Sutton Brothers and Edmonds near Sistersville, W. Va., through lines laid in the Ohio River an appreciable quantity of drip gasoline was formed to provoke the operators. The compressing of the gas and its subsequent cooling by the river water supplied the basic design for the natural gasoline compression plants which were soon to follow.



One of the first compression plants. Note the light construction of the compressors and the horizontal pipe condensers

First Commercial Plant

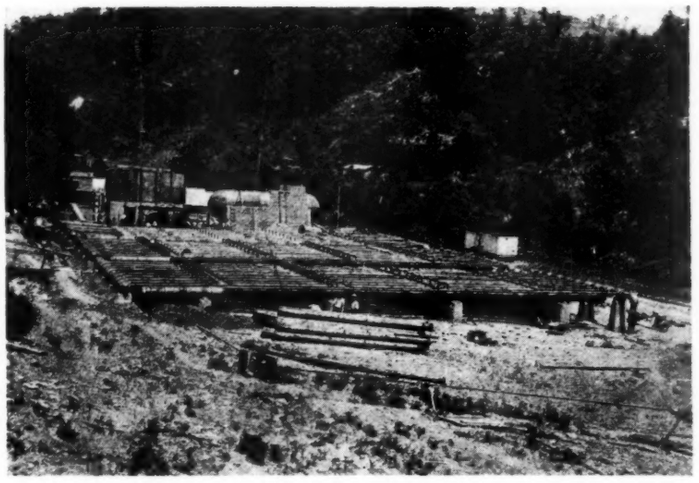
William Fasenmeyer is credited with having recognized the mechanics of this transformation because soon after he built a plant to do this specific work. He was soon joined by Sutton Brothers and Edwards and the Reno Oil Co. in building plants. Their field of operations covered a few old oil wells in the Tidioute, Pa., area and in the Sistersville, W. Va., Pool. The scheme was to pull a vacuum on these wells and on the exhaust side of the pump the gas was compressed to a few pounds and passed through water cooled coils. The gas was exceptionally rich so that despite the low pressure and inefficient means of cooling, a satisfactory quantity of gasoline was recovered.

Higher Pressures

It soon became apparent that by using higher pressures and more effective cooling, a larger quantity of gasoline could be extracted so the Reno Oil Co. decided to build what is believed to have been the first compression plant operated on a commercial scale. This was completed in 1908 near Sistersville. As early as 1905 Rev. William Mayberry had purchased a compressor from the Bessemer Gas Engine Co. and operated a small unit that extracted the gasoline under a gas pressure of 60 pounds. He included in his unit a relatively efficient cooling mechanism and adequate tankage.

Bessemer Process

Prompted by the commercial possibilities presented by the systematic extraction of the gasoline from casinghead gas, together with the application of a suitable process for the extraction of gasoline vapors from gas coming from gas wells, the Bessemer Gas Engine Co. began to design and fabricate suitable units. The Ingersoll-Rand Co. also pioneered in the development of equipment for the growing industry. By this time the oil business was beginning to feel the growing need for gasoline to supply fuel for motor cars in contrast with the desire to evade the production of gasoline in favor of kerosene, only a few years before.



First absorption gasoline plant. It was built by the Hope Natural Gas Co., at Hastings, W. Va., and started operating in 1913.

Rapid Growth

An idea of the importance of the industry at the close of 1911 may be obtained from Table 1. West Virginia was the leading producer of natural gasoline with Ohio and Pennsylvania close contenders for second place.

Whereas the first casinghead gasoline or drip gasoline was used as fuel for drilling operations, to heat lease houses, and for power in drilling wells, it soon found its way into the market as a motor fuel. The industry grew very rapidly so that by 1912 there were 250 plants in the United States.

Early Compression System

All of these plants were of the compression type, employing the simplest forms of compressors, cooling coils and prime movers. At first the compressor was connected with the engine by means of a belt and then direct-driven units were placed on the market.

The compression method of producing gasoline from either casinghead or natural gas involved the use of one or multiple-stage compressors utilizing pressures from 20 to 350 pounds, dependent upon the "dryness" or "wetness" of the gas treated. A typical operation of an early compression plant would be for the gas to pass through a low pressure cooling coil. This would condense out a 70 to 80 gravity gasoline. The uncondensed gas from the compressor would then pass through a high pressure cylinder at 250 pounds or more and the compressed gases would pass through high pressure cooling coils, giving a gasoline of 80 to 90 gravity. The uncondensable gases would be carried into an expansion cooling coil under 250 pounds pressure, where a gasoline of from 90 to 100 gravity would drop out.

Refinement of the process came in the form principally of more sturdy compressors and better designed cooling media. One of the most important of the latter was the expansion type engine. Its function was to permit expansion of the gas from a steam engine cylinder to supply the refrigeration which cooled the hot compressed casinghead gases coming from the main compressor.

The first expansion engine for cooling was installed by A. F. Clark in 1912 at his plant near Butler, Pa. One year later the Gypsy Gasoline Co. installed the first engine of this type in the Mid-Continent area.

It should naturally follow that some use be made of the refrigeration offered by expanding the residue gas in a suitable exchanger so in 1912 Frank Peterson of the Bessemer Gas Engine Co. built a double walled condenser pipe. In it he expanded the residue gas to absorb heat from the compressed casinghead gases as they passed countercurrent through the inner pipe.

Ammonia Refrigeration

In 1917 the Oklahoma Natural Gas Co. went further in its aim to increase plant efficiency and installed an ammonia refrigerating unit in its plant near Tulsa. Cold brine was sprayed into the top of a tower and as the raw vapors passed upward through the tower, some liquefaction took place and formed a layer of gasoline on the brine in the base of the tower. The brine and gasoline were pumped from the tower to a tank where the complete separation of the two took place and the brine was returned to the system. The method proved costly and caused many freezeups, particularly in the tower. The plan was abandoned.

Numerous attempts were made to chill the gas to the dewpoint to avoid compressing it greatly. The idea of the Oklahoma Natural company was expanded to where chilled gasoline was used instead of brine and the trouble of brine dilution due to water carried in the gas was thus eliminated.

Absorption Process

The various difficulties which presented

TABLE 1—PRODUCTION OF GASOLINE FROM NATURAL GAS IN THE UNITED STATES IN 1911 BY STATES

State—	Plants — No.	Plants — Daily capacity (gals.)	Gasoline produced — Quantity (gals.)	Gasoline produced — Value	Value per gallon	Average yield in gasoline (gals.)
West Virginia	71	16,694	3,615,251	$258,619	7.15	2.92
Ohio	40	6,579	1,723,899	122,203	7.09	3.56
Pennsylvania	50	5,669	1,467,043	109,649	7.47	2.79
Oklahoma	8	4,800	388,058	20,975	5.40	2.68
California	...	...	.....	.....	....	....
Colorado	...	.....	.....	.....	....	....
Illinois	7	3,358	231,588	20,258	8.75	2.81
New York	...	.....	.....	.....	....	....
Total	176	37,100	7,425,839	$531,704	7 16	3.00

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

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themselves in the removal of natural gasoline from gas by means of the compression process, particularly that of adequate cooling, prompted the Hope Natural Gas Co., a subsidiary of the Standard Oil Co. of New Jersey, to appropriate a sum of money for investigating the practicability of utilizing the oil absorption process. This process had been known since 1875 when it was used to extract gasoline vapors from the gases coming from oil shale retorts. It had been perfected by the coal tar industry in England for the extraction of benzol and toluol from coal gases. It was used in the Semet-Solvay plant built near Syracuse, N. Y., in 1898.

Although E. D. Leland is accredited with extracting gasoline from natural gas by an absorption process in connection with refrigeration as far back as 1901, it was not until 1913 that the first absorption plant was constructed.

The research needed to ascertain the practicability of applying this process to the new industry was undertaken by the Hope Natural Gas Co. in 1906 and the work was carried out under the direction of George Saybolt.

The industry watched developments most attentively and the findings of the Hope company were guarded equally closely. In the meantime some had built units of their own design. When a patent for the process was granted to George Saybolt in 1911, the industry was presented with an instrument which later supplied the basis for one of the most interesting patent cases in history.

First Absorption Plant

In the years which immediately followed, the Hope Natural Gas Co. built a large absorption plant at Hastings, W. Va. Its operation was started in 1913 and when placed under full load recovered up to 40,000 gallons of gasoline daily. In this year, the National Products Co. built a small commercial absorption plant in the Cleveland, Okla., Field. Its absorbers operated under a pressure of only 10 pounds but recovered more than 1,000 gallons of gasoline daily.

Producers Organize

Need of an organization of manufacturers became apparent at this time so on December 15, 1916, the "Casinghead Gasoline Producers of America" was founded with a directorate of six men including A. N. Kerr, W. M. Welch, F. C. Henderson, J. A. Hull, W. P. Donovan and G. K. Swan. Thomas Chestnut was elected president.

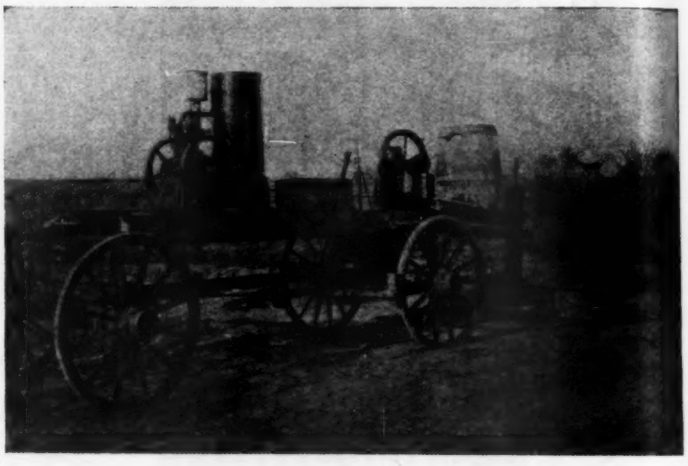
By this time, the natural gasoline industry was beginning to take long strides. The number of plants exceeded 300 and new units were going into the West Virginia, Pennsylvania, Oklahoma and North Texas fields at a rapid rate. The greater number of units in operation were of the compression type but the popularity of the absorption process grew fast under a licensing arrangement with the Hope Natural Gas Co.

Oklahoma Natural Suit

However, there were those in the industry who questioned the patent rights granted Saybolt and built plants which were alleged to be infringements. In 1917 the Hope Natural Gas Co. filed suit against the Oklahoma Natural Gas Co. for alleged infringement. The Oklahoma company was aided in its defense by other companies operating plants of the same general type so during the four years of litigation which followed, the industry was handicapped to some extent. The case was decided in favor of the Oklahoma Natural Gas Co. in the U. S. District Court in Tulsa, and the decision was later sustained by the U. S. Appellate Court sitting in St. Paul, Minn., in 1922.

Design Changed Fast

Revisions in the design of the towers, stills and condensers came fast in the years just prior to the World War and the industry witnessed the introduction of much new equipment on the part of engineering companies. The Feld absorber, in which the oil is broken up as a spray within the tower, was introduced. The Koppers Co. offered complete plants which were designed partly from the experience gained in the by-product coke industry. Direct fired stills were offered in the Merriam process.



One of the early field gas testing units

Charcoal Process

In 1918 a competitor of the new absorption process appeared—it was to be known as the charcoal process and was the result of experiments conducted by G. A. Burrell and G. G. Oberfell. Through an arrangement with the United Natural Gas Co., the company built three plants, one at Singlehouse, one at Roystone and the third at Van, all in Pennsylvania. The process was used in a number of plants which were built later in the Eastern fields and in the Panhandle of Texas. Although effective, the cost of operation was relatively high.

California Enters

While these developments were taking place in the Eastern and Mid-Continent fields, a strong newcomer in the natural gasoline industry was feeling its way among the fast developing California fields. High natural field pressures, the large volume of gas per well and a wide variation in the gasoline content among the new California fields invited a detailed study of equipment design there.

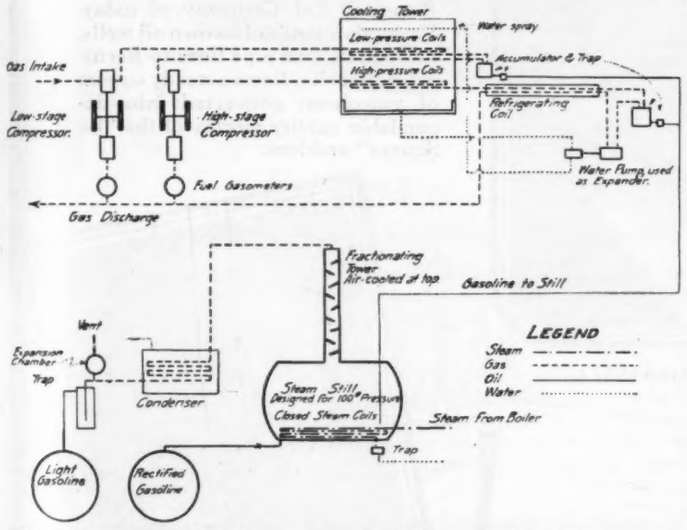
The first plant to be built along the Pacific Coast was that of the Standard Oil Co. of California, known as the Pico compressor plant. It was located near the first refinery in California, that at Newhall. Completed in 1916, the gasoline plant consisted of two compressors,

one a low pressure unit and the other a high pressure unit. Condensation was aided by a series of water-submerged cooling coils and the condensate was then pumped into a steam still equipped with a rather inefficient fractionating tower as one would judge towers now. At that time, however, the idea was looked upon as quite an advance over current practices. This tower was air cooled at the top but permitted little control.

The overhead was a very light gasoline and the product that remained in the still was called a "rectified" gasoline. It was continuously withdrawn. A flow chart of this plant indicates the beginning of such practices as multiple stage compression, complete fractionation and stabilization. In the years which followed, elaborate fractionating columns were developed, among the first of which was that built by the Union Carbide Co.

Had 31 Plants by 1917

By the middle of 1917, California boasted of 31 plants with a combined capacity of 60,000 gallons daily. With plants established in the East, West and Mid-Continent, the natural gasoline industry became national in scope. Its product was not looked upon with favor, however, because it was difficult to handle. It often came to the customer in drums under a high pressure and when the drums were opened from 20 to 60 per cent of the gasoline would be lost. Refiners, who were to become the largest users of this new product did not take kindly to it. In addition to the competition it might offer in common markets, they stamped it as "inferior," "unsafe," "unfinished."



Flow diagram of the Pico compressor plant of the Standard Oil Company of California at Newhall, California

Ardmore Fire

Their views were strengthened by the explosion and fire on September 27, 1915, when a tank car of casinghead gasoline exploded on the railroad siding in Ardmore, Okla., taking 43 lives and injuring more than 500 people. This accident called down upon the heads of the industry the sharpest criticism from the public.

If the Bureau for the Safe Transportation of Explosives, organized under the American Railway Association and the Inspection Bureau of the Interstate Commerce Commission, had not laid down a code of transportation regulations as early as 1911, the number of such accidents might have been much greater.

Organize Gasoline Association

The safety work was also advanced through the organization formed in 1920 at Tulsa to be known as the Association of Natural Gasoline Manufacturers. W. M. Welch was its first president and A. V. Bourque was its first secretary. From the beginning, the association took the job of standardizing, simplifying and regulating the quality of the industry's products in the Mid-Continent.

In the California fields most of the natural gasoline produced went from the gasoline plant directly into pipe lines with the crude to be delivered to refineries for further processing so there was less attention paid to decreasing the vapor pressure on the products there.

This processing of relatively large volumes of natural gasoline through the principal refineries in California probably accounts for the first use of vapor recovery plants by California refiners. Little attention was paid to these new refinery vapor recovery units outside of California, however, until cracking came into general use and then their use became the rule and not the exception.

When the refineries began to install them and to borrow much of the design from the natural gasoline industry, the latter did not realize that some day the practice of recovering refinery vapors would cripple the natural market.

First Insulated Tank Car

Outside of California, means of delivering increasing quantities of natural gasoline had to be found as the industry expanded. It had outgrown the wooden barrel and steel drum stage and was in the tank car stage before two years of its history could be written. The danger involved in its handling suggested the use of insulated tank cars and the first one was built by the General American Tank Car Co. in 1913. Insulated cars have since become the standard of the industry.

Liquefied Gas

Considering the marked progress the liquefied gas industry has witnessed over the past 10 years, and the attendant publicity given each "new" use for liquefied gas, in that time, it might be interesting to the younger man in the industry to turn back the pages of history and read in The Oil and Gas Journal of September 17, 1914, an article by Frank Peterson in which he says in part:

"In such districts as northwestern Canada, where the retail price of gasoline is high, and where wet gas is available and crude oil scarce, and where climatic conditions are severe in winter and the problem of carburetion of heavy gasoline fuels difficult, the driving of motors with liquid gas has both practical and inviting possibilities.

"But for domestic use, for isolated conditions of lighting, heating and cooking service, for laboratory, technical and scientific requirements, for development of intensely high temperatures in small furnaces, for metal cutting and light welding, for marine lighthouse and buoy lighting, the product commands the most ready and useful acceptance."

Why take chances on costly derrick failures?

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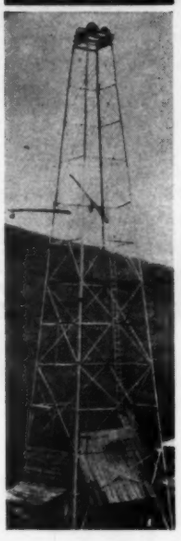

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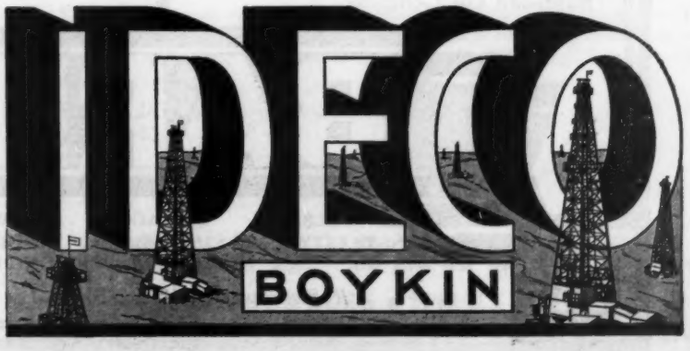


DIAMOND JUBILEE

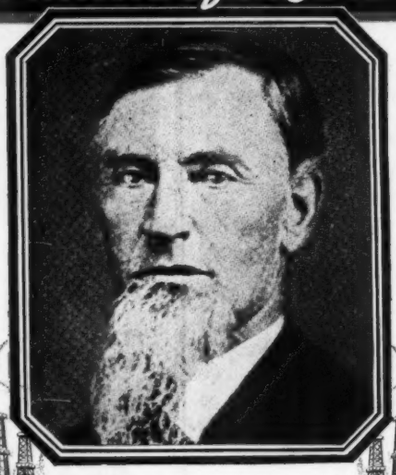
The Barnsdall Oil Company office in Titusville, as it appeared in 1867.

Located just South of East Central Avenue, now the 3rd Ward, Titusville.

1859 **1934**

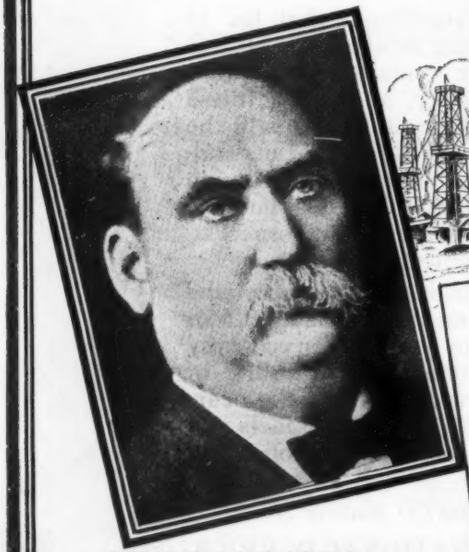
The PIONEER NAME of the OIL INDUSTRY

SEVENTY-FIVE years ago the name of William Barnsdall flashed across the country, the driller of the world's second oil well; again a year later, as the builder of America's first oil refinery. Today Barnsdall is the only pioneer name still remaining in the oil industry.



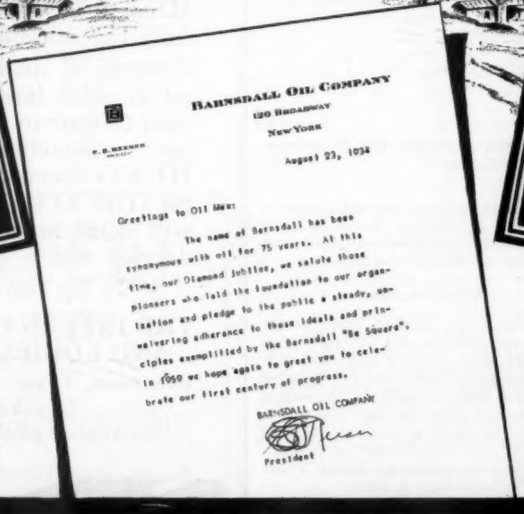
WILLIAM BARNSDALL

From these meager beginnings 75 years ago has grown the far-flung Barnsdall Oil Company of today. From thousands of its own oil wells, through its own pipe lines to Barnsdall refineries, flows a steady stream of petroleum converted into dependable quality worthy of the "Be Square" emblem.



THEODORE N. BARNSDALL

Theodore, son of William Barnsdall, continued in his father's footsteps in the then new oil industry and it was his pioneering that brought into being the present Barnsdall Oil Company.



BARNSDALL OIL COMPANY
120 BROADWAY
NEW YORK

August 23, 1934

Greetings to Oil Men:

The name of Barnsdall has been synonymous with oil for 75 years. At this time, our Diamond Jubilee, we salute those pioneers who laid the foundation to our organization and pledge to the public a steady, unwavering adherance to those ideals and principles exemplified by the Barnsdall "Be Square". In 1959 we hope again to greet you to celebrate our first century of progress.

BARNSDALL OIL COMPANY

President

EDWIN B. REESER

Edwin B. Reeser, an early associate of Theodore Barnsdall, a leader in the industry (President of the American Petroleum Institute 1928-31) and today President of the Barnsdall Oil Company.

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AQUAGEL is a specially selected and prepared clay almost entirely consisting of gel-forming colloidal particles, which are responsible for most of the desirable qualities of drilling muds. AQUAGEL and water alone make an excellent drilling mud weighing 64 pounds per cubic foot. One ton of AQUAGEL produces 140 to 180 barrels of such mud, thus effecting a great saving in mud costs.

AQUAGEL is used to: Prevent costly fishing jobs, caving, loss of circulation, stuck drill pipe and casing; Reduce abrasion, with consequent savings in replacement of pump parts, etc.; Seal off fissures and caves, and minor flows of gas and water; Insure landing of long strings of casing without sticking.

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STABILITE assures the following advantages over ordinary products: Lower final viscosity of treated mud; Less chemical required; Permanency of viscosity reduction; No hazards in mixing or handling; Lower mud treating costs.

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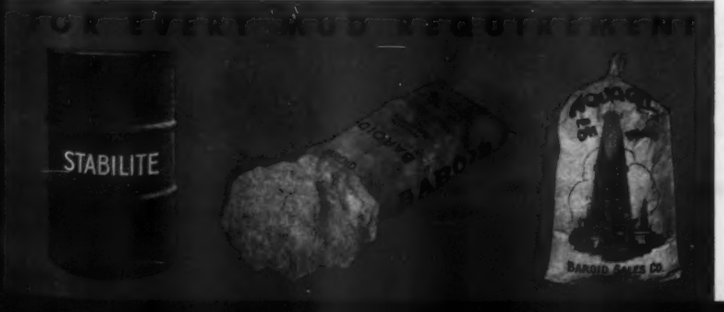

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On the 75th Anniversary of the Oil Industry Linde Leadership Marks Progress with New Achievements

IN THE 75-year history of oil one of the outstanding developments has been the rapid growth of welded pipe lines. Though comparatively young when contrasted to the industry as a whole, this process of joining pipe has made rapid strides since its inception a little over 20 years ago.

Early Projects

Oxwelding of overland pipe lines first attracted the attention of the world in 1914, when it was used for the construction of high pressure gas mains at the Panama Pacific Exposition at San Francisco. Previous to this an 11-mile gas line was laid in 1911, south of Philadelphia.

First Oil Line Welded in 1920

The Prairie Pipe Line Company was first to adopt welding as standard for its lines. This pioneer effort was started with Linde products in December, 1920, with the laying of a 15-mile, 8-inch oil-carrying line from Bartlesville, Okla., to the Cherokee Station, near Ramona, Okla. A little later this company laid the first long welded oil pipe line in the United States, 140 miles from Mexia to Hensley, Texas.

For his original work in connection with these two projects, Mr. N. E. Wagner, Superintendent of Welding for the company, was awarded the Morehead Medal by the International Acetylene Association in 1923.

Original Lines Still in Service

Today, these first oil lines welded by the oxy-acetylene process are still rendering satisfactory service . . . operating almost continuously.

Welding Quickly Spreads

From these early beginnings oxy-acetylene welding and cutting has quickly superseded older methods of laying pipe lines. In 1924, the size of pipe being welded was increased from 8- and 10-inch oil lines to 16- and 18- inch gas lines welded by the Magnolia Gas Company and then to 20-inch by that company and the Lone Star Company in the following year or two. From then on, larger and larger pipe lines were welded up to the 26-inch lines of today. These lines that carry oil, gasoline and gas from the fields to the refining plants or city mains are sometimes over a thousand miles long. They are buried in ditches on land, but frequently they have to be laid across river-bottoms or swamps and in the sea. Needless to say, the thousands of joints in these lines have to be absolutely leakproof otherwise, valuable gas and oil would be lost, and miles of pipes would have to be dug up for repair.

Standard Construction Today

Today, practically every important pipe line is welded. Welding is the proved and accepted method with leading pipe line companies and contractors. They know that once a pipe joint has been welded and tested, it will last as long as the pipe itself. Striking proof of this has been found when terrific floods or earthquakes have torn and broken the pipe itself without as much as cracking the welded joints. Many times welded pipe lines were the only ones not completely torn apart and ruined.

Linde Constantly Fosters Progress

Much of the progress of oxy-acetylene welding and cutting in pipe line construction has been fostered by The Linde Air Products Company. Linde engineers are constantly striving in a never-ending quest for improvement in welding and cutting techniques, materials, rods, gases and equipment.

Develops Speed Lindewelding

Linde developed Lindewelding—a new technique—that doubles or triples the daily production of sound welded joints. It assures stronger pipe joints through a better and faster method of oxy-acetylene welding. It saves 35 to 40 per cent in materials, 30 to 60 per cent in time.

Lindewelder Increases Production

The Lindewelder was another improvement brought out by Linde. This appliance further increases the speed of Lindewelding, and makes the operation almost automatic. Other advances include the Multi-Flame Head for Lindewelding and the Wagner Pipe Cutting Machine for cutting and beveling pipe in the taking up and reclamation of old pipe lines.

Uses of Welding and Cutting Limitless

Oxy-acetylene welding and cutting may be truly termed the process of a thousand uses. In addition to its wide field of application on pipe lines and gathering systems, it is also used extensively for the erection of storage and gasoline plants and in refineries. Typical applications include: heat exchangers, piping of all sizes, vapor lines, condenser lines, structural steel work, absorbers, coils in cooling towers.

Oxwelding and cutting effect large savings in repair work and the salvaging of old equipment and abandoned pipe lines.

The oxy-acetylene blowpipe also is used to hard-face cutter bits and other equipment subject to wear. A coating of wear-resisting metal such as Haynes Stellite, Haystellite Composite Rod, High Strength bronze or High Test steel on the points of wear increases the productive life of parts 2 to 10 times.

March of Progress

Woven into the seventy-five year's history of the petroleum industry is the pioneering work done in the past two decades by the men who typify Linde Process Service. It is a truism that the important advances made in any industry during its continued growth are due as much to the unselfish efforts of men as improvements in materials and processes.

What is Linde Process Service?

Linde men on the firing line exemplify and crystalize a service rendered above and beyond the purchase of tangible goods. They are the direct contact in the field. They work closely with users of Linde Oxygen, assist them in training and qualifying operators and help organize the most efficient welding operations. Yet, this is only the visible evidence of what Linde Process Service means. Linked to the army of service operators are the combined efforts of scientists, engineers and metallurgists constantly working toward improvements in welding technique, materials and apparatus.

Back of the service operators come service supervisors, resident engineers, consulting, development and research engineers. Their work is highly important. Hundreds of practical and theoretical problems in metallurgy and in the application of the oxy-acetylene process for pipe-line work are constantly studied by these men. The results of these studies enable Linde service operators to give greater service to Linde customers by bringing to their jobs the latest and best pipe-line welding methods.

Linde Cooperation Continuous

Linde has a continuing interest in its customers. It exerts every facility to assure them the highest satisfaction and most profitable use of the Linde products they buy. The nearest Linde Sales Office will be glad to tell you how Linde Process Service can be of help to you. Without cost or obligation, it will gladly furnish complete data to users of Linde Oxygen on welding piping methods. It will make available also such further technical assistance your engineers or construction men may require. Linde Sales Offices are located at Atlanta, Baltimore, Birmingham, Boston, Buffalo, Butte, Chicago, Cleveland, Dallas, Denver, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Phoenix, Pittsburgh, Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle, Spokane, and Tulsa. Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through 126 producing plants and 859 warehouse stocks.

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

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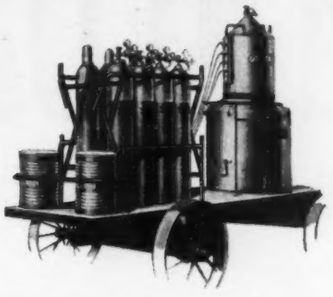
You are cordially invited to visit the welding demonstrations and the numerous other exhibits sponsored by the Corporation in both the Basic and Applied Science sections in the Hall of Science at Chicago's 1934 A Century of Progress Exposition. Here you will see how users of oxy-acetylene welding and cutting, and other products and processes developed by Units of Union Carbide and Carbon Corporation benefit from a most unique coordination of scientific research with manufacturing, sales and service facilities.

You can order everything for Pipe Line Welding from Linde



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· HIGHLIGHTS IN WELDING HISTORY ·

1920—MAKING HISTORY—The last weld being made at Cherokee Station, near Ramona, Okla., on the first oil line to be welded. This 15-mile, 8-inch line is still giving satisfactory service.

1921—FIRST LONG welded oil pipe line in the United States, 140 miles from Mexia to Hensley, Texas. Today, this line is still on the job and many thousands of miles of welded pipe lines cover the country.

1930—NORTH TO SOUTH—On the 24-in. gas pipe line from Amarillo, Texas to Chicago, Ill., oxy-acetylene welding did its part to assure a long-lasting job on such a huge undertaking.

1931—OVER THE MOUNTAINS—On the longest 26-in. gas line, laid over the mountains between Kettleman Hills and Los Angeles, Lindewelding set a record for fast daily production of sound welded joints.

1934—NEW SPEED RECORDS—At the Tulsa Oil Show this Spring, new speed records in welding were chalked up. With the Multi-Flame Lindewelding Head welds were made in 12-in. standard ¼ in. wall pipe in 7½ to 8 minutes.

IN ACTION—Out in the field we see the Multi-Flame Lindewelding Head setting new records for fast production on pipe lines. Better, stronger welds in less time, less material and least cost.

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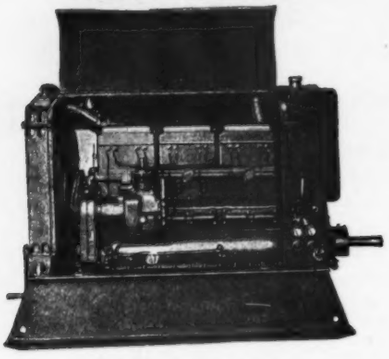

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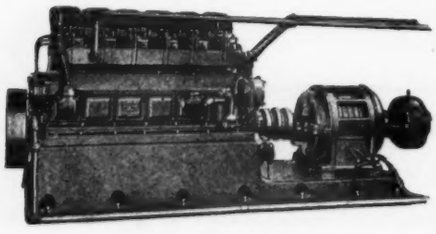

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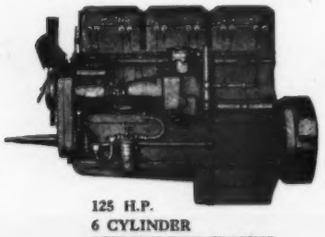

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Oil barge fleet discharging gasoline at Ohio River station

VITAL CHANGES IN PIPE LINE METHODS AND PRACTICES HAVE COME SINCE 1926

Ditching machine

TRANSPORTATION—ERA NUMBER 5 1919-1934

Major improvements in pipe line transportation and practice and in tanker construction and operation were made during the present era, or since 1919. Most of this exceptional progress in extension of facilities, speeding up work and eliminating old practices in favor of greater efficiency and economy has come during the lifetime of the present generation.

Pipe line systems for the transportation of crude oil in the United States at this time total approximately 59,000 miles of trunk lines and 55,000 miles of gathering lines. For the transportation of gasoline, there has been constructed about 4,050 miles of pipe line, all but 40 miles of which was built since 1927. At the present time there are 1,680 tankers in operation. This pipe line mileage is in addition to the vast network of thousands of miles of 20 and 24-inch lines constructed to large cities from the natural gas fields opened up in Louisiana, the Texas Panhandle and California which were built during this period. Pipe lines in the United States at this time transport more than 2,500,000 bbls. of crude oil daily.

The enormous extension of facilities for pipe line transportation for both crude oil and gasoline in this modern era naturally developed vast improvements in equipment, materials and operating practices. The machine age was inaugurated in the construction of pipe line, most of the work previously done by manual labor being performed by machines which can do many times the work in far less time. Engineers and technicians of the pipe line industry have been especially busy during this era with the result that operations have been made more efficient, less costly and larger quantities of crude can now be handled in pipe lines at far less expense than was the case only a few years ago. A number of companies have just during the past year started to modernize existing crude oil pipe line systems as a result of research and experimental work which proved that considerable savings in money and greater efficiency could be obtained under new operating practices.

Modernizing Present Systems

It has been ascertained that it is less expensive to operate a large single line than the smaller parallel lines built up over a period of years. The development by manufacturers of seamless pipe and high tensile strength steel made the new operations possible. One of the new practices being used by companies in modernizing their pipe line systems is to replace the lines laid several years ago and consisting mainly of 8 and 6-inch pipe with single lines of 12-inch, high tensile strength pipe. As an example of how this system works out, one pipe line company in the Mid-Continent area recently took up 38 miles of 6-inch pipe and 15 miles of double 8-inch pipe, a total of 68 miles of 6 and 8-inch pipe which had been laid in loop, and replaced these lines with a single 12-inch line 15 miles long to a junction point. This 15 miles of 12-inch pipe has the same capacity as the three lines totaling 68 miles of 8 and 6-inch pipe.

Until about 1926 improvements in the oil pipe line industry came slowly because good practice was determined largely by precedent in years of usage. Since that year, however, radical changes in pipe line practice have come in quick succession as a result of a rapidly expanding industry. During this time the industry has witnessed the adoption of the multi-stage centrifugal pump for high pressure service; the electrical motor as a prime mover for pipe line pumping has made its advent and proved reliable in service; seamless line pipe was introduced; the welded joint has replaced the screwed coupling for main line construction; the 40-foot length of pipe is being used in preference to the 20-foot length for trunk line systems; higher carbon steel pipe with a tensile strength of 64,000 to 80,000 pounds has come into general use; and machinery is now employed for most of the work in constructing trunk line systems, such as ditchers, backfillers and tractors for handling large diameter pipe, for bending the pipe and for raising old lines to be reconditioned.

Advent of Centrifugal Pump

The centrifugal pump came into use in the Mid-Continent for trunk line service at booster stations midway between the main line reciprocating units. Pipe line companies did not have sufficient time to build pipe line loops to take care of the large flush production of the Seminole Field in Oklahoma in 1926-27, and the electrically driven centrifugal pumps were installed to relieve the overburdened trunk lines. The centrifugal pump proved so reliable in this booster pumping service that its use was soon extended to permanent main line pumping units on some of the trunk lines out of West Texas.

As the use of the centrifugal pump was a radical departure from pipe line pumping practice so the electrical motor brought about a radical change from the old practice of using only steam, oil, or gas engines for pipe line pumping.

The development of seamless pipe marked a very important change in the use of line pipe for trunk line service. A small amount of seamless pipe was tried out on some of the long pipe lines which were built during the first part of 1928. So successful was the use of this seamless pipe in these trials that it was used in a long welded pipe line constructed that year.

No sooner had the industry adopted the use of seamless line pipe than it was offered a competitive class of pipe made with electrically welded seams. A large amount of this class of pipe was used for trunk pipe lines.

The industry also had made available to it by the steel industry a line pipe with an electrically welded seam made by the flash welding method.

The trend of pipe line practice has been to the use of higher tensile strength steel and thinner walls. Such advantages as lower freight, stringing and laying costs, lower overall investment, greater inside diameter and consequently an appreciable increase in capacity for this class of pipe have made it very attractive.

Acetylene and Electric Welding

Prior to 1926 there were only a few companies that had used acetylene welding for pipe lines but after that year the screwed joint yielded to the acetylene welded joint which became common practice. During 1929 electric welding came

Electric welding of pipe line

into extensive use for welding together the bell and spigot or back-up ring joint of the larger sizes of pipe especially in gas lines, but the use of electrical welding for butt joints without back-up rings did not come into extensive use for oil lines until 1932 and 1933.

Electrical welding revolutionized the methods of repairing oil lines since this type of welding permitted the patching of lines and welding of couplings with oil in the line. Electrical welding has been used extensively since 1928 for the repairing of lines.

Use of Electric Motors

The use of the electrical motor for pipe line pumping permitted the construction of an automatic pipe line pumping station and of a remotely controlled pumping station. Several automatic, remotely controlled stations have been constructed and operated in the Mid-Continent area.

About 1927 two major oil companies built a long trunk oil pipe line under the provisions of joint ownership. In 1929 two other major oil companies built a long trunk line under joint ownership. From the engineering and economic viewpoint the joint ownership of newly constructed pipe line seems to have distinct advantages.

Aerial photography for a number of years has been used by the pipe line industry for making surveys for pipe lines into new regions. This method of selecting routes for pipe lines has saved the pipe line industry considerable money, time and trouble.

An especially important feature in the latest design of oil pipe lines has been the use of larger diameters in pipe and higher pressures. Twelve-inch welded pipe lines, operated at a pressure of 750 pounds pressure per square inch, are in common use at this time.

To offset the inroads made by electrical power companies in supplying power for field gathering stations to pipe line companies, the manufacturers of Diesel engines designed for the industry a high speed, solid injection, Diesel engine, connected through a speed increaser to a centrifugal pump. These units weigh between 5 and 7 tons and are semiportable.

The steam pump has been replaced largely by gas or gasoline motor-driven engines connected by some type of belt to reciprocating pumps for gathering oil from leases in the large oil fields. The motor on such a unit is designed for 50 horsepower and the pump has a capacity of 4,000 to 5,000 bbls. per day at 150 pounds pressure.

During the past 10 years or so there has been an extended use of the floating type of roof on pipe line working tanks which has resulted in an appreciable reduction in evaporation losses. Other types of roofs and evaporation saving devices have been developed and enjoy widespread use in the pipe line industry.

The pipe line industry has been a leader in efforts to solve the problem of corrosion which costs the petroleum industry millions of dollars a year. Assistance has been extended to manufacturers of coatings and with the co-operation of the American Petroleum Institute, American Gas Association and the U. S. Bureau of Standards, manufacturers of protective coatings and the pipe line companies have made considerable headway in reducing to a minimum serious losses in money and operating time due to corrosion of pipe lines.

Machines were developed and used extensively in the pipe line industry for coating and wrapping pipe and for detecting breaks in coatings which might permit corrosive action to get under way.

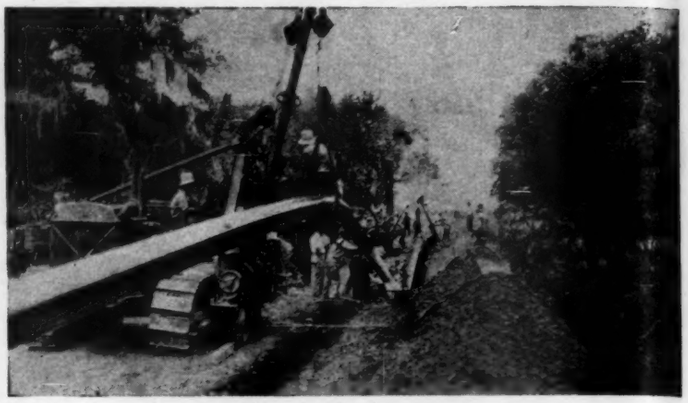
The Gasoline Pipe Line Era

Outstanding in this era is the rapid and extensive development of gasoline pipe line systems. As described in the article on the fourth era of transportation, the first gasoline pipe line built in the United States was the 40-mile, 3-inch carrier from Salt Creek to Casper, Wyo., constructed in 1917 and placed in operation January 1, 1918.

The second gasoline pipe line in the United States was built early in 1928 by the Shell Oil Co. of California, it being a 4-inch welded line from the Ventura Avenue Field to the Shell's Wilmington refinery near Los Angeles harbor, a distance of 97½ miles. In addition to being the longest gasoline pipe line in the world at that time, this line, as far as can be ascertained, was the first pipe line to operate with an automatic pumping station. This station was located at Simi. It consisted of a boiler riveted steel pressure tank attached to which were four float cages. Two of these floats were set to operate a mercury switch which started and stopped the motor automatically. The other two floats were connected to ball bearing throttle valves, one on the suction line and one on the discharge line. These valves and floats were so set that a consistent governable quantity of liquid was kept moving through the station at all times.

In 1929 the Tuscarora Oil Co., Ltd., changed its screwed oil pipe line, across the state of Pennsylvania, into a gasoline pipe line. This line had transported crude oil for many years. The flow through the line was reversed, crude oil having been transported from west to east, while the gasoline was pumped from the Bayway, N. J., terminal of the line to Cooks Ferry on the Ohio River on the western boundary of Pennsylvania. The changing over of this pipe line to carry gasoline also resulted in an extended movement of gasoline in specially constructed barges on the Ohio and Mississippi Rivers. The barges used in this service averaged 150 feet long by 35 feet wide with a depth of 10 feet, 3 inches. Each had a capacity of 7,000 bbls., the equivalent of an ordinary train of tank cars. Each barge was equipped with rotary pumps and a gasoline driven engine, capable of propelling the barge. Smaller barges were constructed for service on the shallower streams. They averaged about 140 feet long, 26 feet wide, 9½ feet deep and had a capacity of 4,500 bbls.

Hand operated spiral wrapping machine used in protecting pipe against corrosion



Heavy tractor and cradle used in handling pipe

Many Lines Constructed

The year 1930 might be styled the gasoline pipe line construction year. Early in this year the Sun Oil Co. organized the Susquehanna Pipe Line Co. and that company constructed a gasoline pipe line system from its refinery terminal at Marcus Hook, near Philadelphia, to Pittsburgh, Akron, Ohio, and Cleveland, Ohio. A northern line was constructed to Syracuse, N. Y.

The Standard Oil Co. of New York constructed a gasoline pipe line to connect its tidewater Gulf terminal at Providence, Mass., with Worcester and Springfield.

In 1930 the Phillips Pipe Line Co., a subsidiary of the Phillips Petroleum Co., constructed an 8-inch gasoline pipe line 681 miles long from Borger, Tex., to St. Louis, with a 6-inch branch line to Kansas City.

Later in 1930 the Great Lakes Pipe Line Co. was organized with stock interests held by the Barnsdall Oil Co., Continental Oil Co., Skelly Oil Co., Pure Oil Co., Mid-Continent Petroleum Corp. and the Phillips Petroleum Co. This company constructed a gasoline pipe line 1,350 miles long of 8 and 6-inch pipe. The line extended from refineries at Okmulgee and Ponca City, Okla., through Kansas to Des Moines, Iowa, and thence to Minneapolis and St. Paul and to Chicago, with branch lines to Council Bluffs and Davenport. Just recently the line was looped between Kansas City and Des Moines, a distance of about 158 miles.

On November 28, 1931, the Keystone Pipe Line Co., a subsidiary of the Atlantic Pipe Line Co., started construction of 250 miles of 4, 6 and 8-inch line from Philadelphia to various points in Pennsylvania and the New York state line. On this line there are 11 distributing terminals and two pumping stations.

Extensions in California

California was active during this period in the construction of gasoline pipe lines. In 1929 the Standard Oil Co. built a 74-mile line from Kettleman Hills to Estero Bay.

The Union Oil Co. built a line from Kettleman Hills to San Luis Obispo, a distance of 88 miles.

Other lines were constructed by the Shell, General Petroleum, Standard Oil Co., Union Oil Co., Rio Grande Oil Co., and the Texas Co., extending from Ventura on the north and west to Olinda and Richfield on the east and through Santa Fe Springs, Athens and down to the coast at Wilmington, Long Beach and Huntington Beach.

East Texas Construction

Probably the most active era in pipe line construction ever experienced by the petroleum industry was following the discovery of the East Texas Field and the bringing in of the Joiner well in Rusk County, Texas, in October, 1930. Independent pipe line companies were formed and built several gathering systems and short lines to loading racks on the railroads.

The Humble Pipe Line Co. constructed an 8-inch line from the Kilgore Pool to connect with its Van-Louisiana line south of Longview, Tex.

During a period of nine months, 10 trunk pipe lines were constructed out of the district with four lateral lines connecting to Mid-Continent-Gulf Coast main line systems and three other trunk lines were under construction. By the late summer in 1931 total daily capacity of trunk lines serving the field was 544,500 bbls. with lines of 135,000 bbls. capacity under construction.

Pipe line companies especially active at this time in this area were Arkansas, Atlantic, Atlas, Gulf, Humble, Liberty, Magnolia, Shell, Sinclair, Texas, Sun, Yount-Lee and Texas-Empire.

In addition to many extensions and loops constructed by pipe line companies during this era, two major pipe line projects were placed in operation.

New Trunk Lines to East

In June, 1930, the Ajax Pipe Line Co., a subsidiary of the Standard Oil Co. (New Jersey), started construction of a twin 10-inch pipe line from the Glenn Pool, near Tulsa, to Wood River, Ill., where the line connects with the Illinois Pipe Line Co.'s system. Construction of this line by the Ajax permitted the Standard Oil interests to transport crude from the Mid-Continent area to its eastern refineries. This line is so constructed that one line can be changed quickly to transport gasoline.

Also, in 1930 the Gulf Pipe Line Co. constructed a long trunk pipe line from the Glenn Pool to Dublin, Ind., where the line branched northeast to Lima, Ohio, to connect with the Buckeye system extending to Toledo, and to Pennsylvania where the Southwest Pipe Line Co. carries the Gulf crude to Pittsburgh. A branch from Dublin, Ind., also was constructed to Cincinnati, Ohio.

It was also during this period that the first pipe line from the Rocky Mountain area was constructed to the Mid-Continent, thereby giving an outlet for the large production of the Salt Creek Field in Wyoming. Early in 1920 the name of the Sinclair-Cudahy Pipe Line Co. was changed to the Sinclair Pipe Line Co., and in February, 1921, half of its stock was purchased by the Standard Oil Co. (Indiana). This company then began an extensive program, extending through 1922 and 1923, during which time it in-

creased the 18,000-bbl. capacity of the line to the Chicago district to 45,000 bbls. per day; extended the trunk line in Texas which, in 1921, had been built to Mexia, on down to Houston and in March, 1923, started construction of the 40,000-bbl. capacity line from the Salt Creek and Teapot Dome areas in Wyoming to the company's main line at Freeman, Mo., in the Kansas City district. Within a year, this line, 720 miles in length, was finished, it being the first and only pipe line from Wyoming to the Mid-Continent area. Some time after the Sinclair lease on Teapot Dome were cancelled, some of the station equipment on the line was removed to other parts of the company's system and later a part of this crude oil pipe line was leased to a natural gas company and it is being used now for the transportation of natural gas through that territory. Most of the line was constructed of 12-inch pipe.

In 1923, deliveries of crude were started to the Standard Oil Co.'s refinery at Sugar Creek, Mo., and to the Sinclair refinery at Sinco, Texas.

Under the joint ownership of the Sinclair and the Standard Oil Co. (Indiana) in 1925, the capacity of the line to Houston was increased and during the ensuing three years extensive additions to the gathering system, particularly in the Greater Seminole and Oklahoma City Pools in Oklahoma, were built. In 1928 the capacity of the trunk line from the Mid-Continent Field to the Chicago area was increased from 45,000 to 75,000 bbls. daily.

Stanolind Pipe Line Co.

In 1930 the Standard Oil Co. (Indiana) purchased the Sinclair owned half of the company and in September the name of the corporation was changed to "Stanolind Pipe Line Co." In 1931 the capacity of the main line to Chicago was increased from 75,000 to 90,000 bbls. daily and in that same year deliveries were started to Neodesha, Kans., and through joint tariffs with the Prairie Pipe Line Co. to Wood River, Ill.

In the summer of 1933 the Pan American Pipe Line Co. leased from Stanolind the latter's trunk system from the Mexia district in Texas to Houston and built extensions from near the latter point to Baytown and Texas City, Tex. These lines, together with the rest of its system, are operated by Stanolind Pipe Line Co. from its Tulsa office.

Late in 1933 and in 1934 extensions were completed into new fields of Oklahoma and into West Kansas.

Prairie-Sinclair Merger

This modern era saw the merger of the Prairie Pipe Line Co., the largest pipe line company in the world, with the Consolidated Oil Corp. (Sinclair), the merger being effected early in 1932 and the name of the company being changed to the Sinclair Prairie Pipe Line Co. The Prairie had been active throughout the Mid-Continent area since it laid the first pipe line constructed in Oklahoma, that being in 1904. With the discovery of the different pools in Oklahoma and Kansas, the company extended its system to serve the new pools. In 1920 it entered the Wichita Falls district of Texas and in 1922 it built a line into the Mexia district in Texas. The Prairie secured an outlet to the Texas Gulf Coast in 1925 and through the acquisition of the Pure Pipe Line Co. of Texas.

The Prairie and Noah E. Wagner, then connected with that company, are given credit for introducing acetylene welding into the oil pipe line industry. In December, 1920, the Prairie started work of welding a 15-mile, 8-inch oil carrying line from Bartlesville, Okla., to the company's Cherokee station, near Ramona, Okla. Despite the fact pipe was furnished for the job in lengths of from 17 to 24 feet, instead of 40 feet, the work was finished in good time and the line when tested under 700 pounds cold water pressure, developed only two small leaks. These were repaired and the line then was tested under 800 pounds pressure for 48 hours, no leaks developing. A scraper

An acetylene welder "doing his stuff"

then was started through the line and, to the surprise of some of the officials, it passed through the line in about an hour less time than ever had been required to pass a scraper through any of the screwed coupling lines which paralleled the welded line. Officials feared icicles would retard movement of the scraper and of the crude.

The company welded another short line and then decided to weld the 140-mile 8-inch line it desired to construct from Mexia to Hensley, Tex. This line was welded and it was the first long-distance welded oil pipe line in this country. From that time on the Prairie welded all its newly constructed pipe lines.

During the Luling, Tex., boom in 1923 the Magnolia Pipe Line Co. laid 180 miles of 8-inch welded line from Luling to Beaumont, that being the longest welded pipe line at that time.

The Pure Oil Pipe Line Co. of Texas grew out of the Mexia, Tex., boom. The company laid an 8-inch line from Mexia and Powell to Smiths Bluff on the Neches River, between Beaumont and Port Arthur. This was the line absorbed by the Prairie, as mentioned above.

Lines to Texas Panhandle

With the development of prolific oil production in the Texas Panhandle a number of the larger pipe line companies constructed pipe lines into that field. The Prairie in 1926 laid 208 miles of 8-inch line from Kings Mills in Gray County to connect wth its main system at Addington and Ringling, Okla.

The Gulf Pipe Line Co., also in 1926, constructed a line from the Texas Panhandle to Truscott, Tex., where it connected with a line built by the Magnolia Pipe Line Co. from Ranger. In connection with the development in West Texas the Gulf, in 1927, laid a line from the Winkler, Yates and McElroy Pools to Ranger, Tex.

With the discovery of good production in southeastern New Mexico, several pipe line companies extended their lines to serve that area. The Humble Pipe Line Co. was the first to get its line into the field, that being early in 1930. The Atlantic Pipe Line Co., which was very active in different sections of Texas during this era and which had constructed an electrically equipped pipe line from the Port Arthur section of the Gulf Coast to Midland, Tex., followed the Humble into the Hobbs, New Mexico, section, very quickly. Other lines were constructed to Hobbs by the Shell and Texas companies.

During 1916 the Roxana Petroleum Corp. decided to construct its own pipe line system, moving oil from the Healdton field in southern Oklahoma to its refinery at East St. Louis, Ill. A subsidiary company was formed called the Yarhola Pipe Line Co. and the line was built in 1917. A feature of that line was that it was the only pipe line system at that time equipped throughout with cast steel main line fittings and pump connections and that it was a solid 10-inch line for its entire length. In 1923 the name of the company was changed to the Ozark Pipe Line Co., this later becoming the Shell Pipe Line Co.

In 1926 the Shell extended its line from East St. Louis to its refinery at Chicago. It also constructed an extensive pipe line system in Texas, its trunk line extending from Hendricks and other pools in West Texas southeast to Houston, Tex., and northeast through Archer, Tex., and the principal fields in Oklahoma and connecting with a line to East St. Louis and Chicago.

Double head powered pipe cleaning machine working on 12-inch oil pipe line, followed by primer coating gang

Quick Growth of Humble

The Humble Pipe Line Co.'s system had the quickest and widest expansion of any of the major pipe lines in Texas. As stated in the article on the fourth era, this company started with the Ranger, Tex., boom in 1918, building an 8-inch line from Comyn, Eastland County, Texas, to the Gulf Coast below Houston. The company early entered the Mexia and Powell fields, laying lines to connect with its main line at Hearne, Texas. Lines were constructed as the different fields were developed in Texas, an extension being made west to take care of the Big Lake Field and the capacity of the trunk line from Hearne to Webster, Tex., near Houston, being increased from the original 20,000 bbls. per day to 100,000 bbls. daily. The company constructed a line from the Duval-Jim Hogg Counties fields to the Gulf Coast at Ingleside, near Corpus Christi and established a large tank farm there and docks for tankers. Tanker transportation from Ingleside became quite a factor in transportation of crude oil.

Developments in California

Two noteworthy events in California pipe line history took place in 1925. The first Diesel engine equipped pipe line was installed on the Pan American's 137-mile 10-inch welded line from the Midway Field to San Pedro. Second, the Associated Oil Co. laid two submarine lines off shore for loading tankers—one from Ventura and the other from Monterey. The submarine lines were approximately 3,000 feet long. There were a single 10-inch line at Ventura and an 8-inch and 12-inch in parallel at Monterey.

The Pacific Oil Co. was formed in California in 1920. It took over the interests of the Southern Pacific Co. and acquired an interest in the Associated Oil Co. Also a one-third interest was obtained in the Associated Pipe Line Co. (later acquired by the Standard Oil Co. of California when it consolidated with the Pacific Oil Co. in 1926).

The Long Beach Field was opened by the Shell Co. in 1921. In 1922-23 pipe line activities reached feverish intensity. Signal Hill, Santa Fe Springs, Huntington Beach, Torrance and Domingues flooded the territory with crude. Entirely new methods in disposing of California oil resulted. Much crude was hauled by tanker to San Francisco Bay and pumped south to tank farms in the vicinity of Bakersfield and tremendous quantities were moved eastward by tankers through the Panama Canal. The movement of California crude to Atlantic Coast refineries by tankers during this period had a most important influence on the crude oil situation throughout the country. Millions of barrels of California crude were transported by tankers from the Pacific to the Atlantic seaboard.

Considerable attention was directed at this time to rapid loading of tankers. Centrifugal pumps were utilized and the California Petroleum Corp. is said to have established a ship loading record at Wilmington when it pumped 28,350 bbls. per hour into a tanker.

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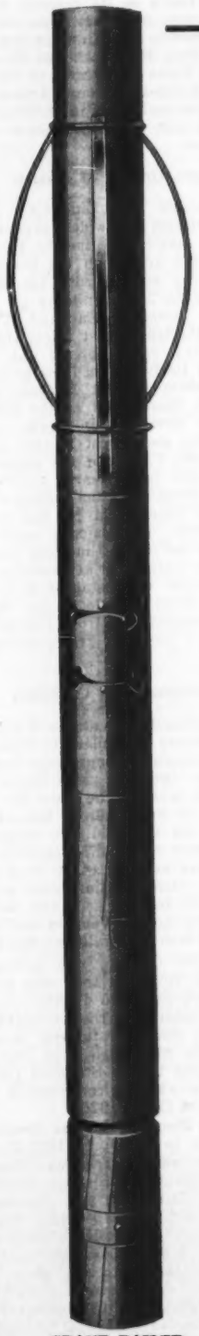

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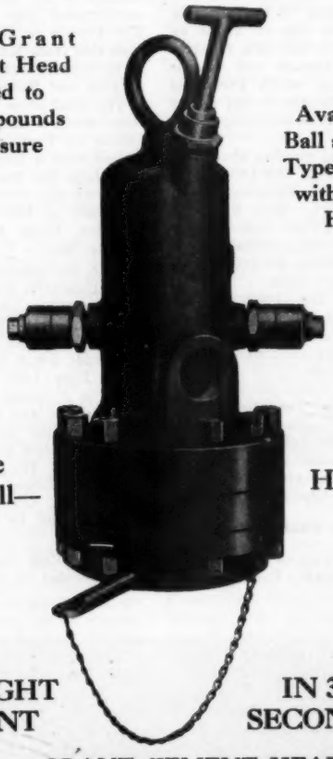

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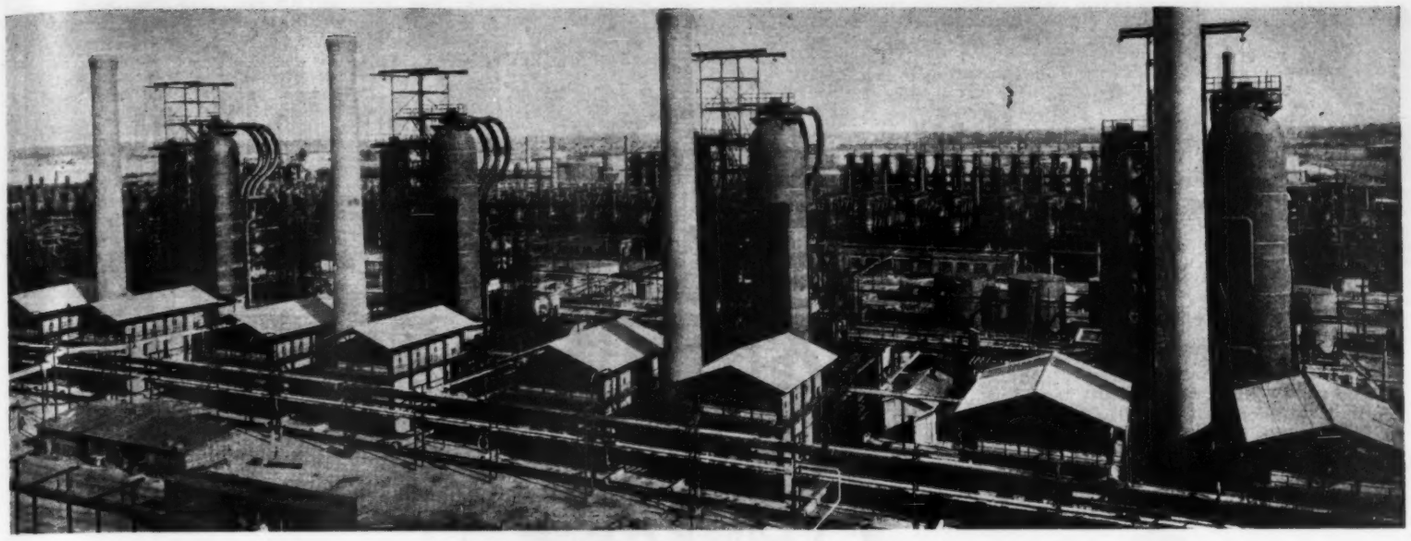


World's largest installation of two-stage distillation units

MORE TECHNICAL CHANGES TOOK PLACE IN REFINING DURING THE PAST FIFTEEN YEARS THAN OVER ITS ENTIRE PREVIOUS HISTORY

REFINING—ERA NUMBER 5 1919-1934

In the year 1919 we see the refining industry adjusting itself to new conditions following the greatest war in history. The United States had been supplying the oil needs of nearly all of Europe, and early in the long period of rehabilitation ahead refiners in this country realized it would be necessary to continue in that role for some time. They were equipped to do this and, in addition, were ready to serve the mounting demand for gasoline in this country.

High crude oil prices during the war had stimulated drilling and there was an ample supply of crude ahead. However, in the minds of everyone connected with the oil business there was that expressed fear of a shortage within the following 10 years. As we know now, these fears were not justified for the production of crude has since been maintained in excess of demands. In fact the mounting stocks have ceased to be looked upon as insurance against future needs and are admittedly burdensome.

Need to Refine Crude

Each of the larger integrated companies realized years ago that if it was to continue to expand producing activities faster than our needs demanded, it would be advisable to refine the oil and sell it in the form of finished products. This rush to gain markets for crude oil by refining it naturally caused a boom in plant construction. It was only natural that a similar boom be witnessed in filling station construction for these same companies reasoned that more crude oil could be sold as gasoline through controlled retail outlets than if they were to depend upon outsiders.

Obviously, the world could absorb only so much crude oil despite the form in which it was offered and when the vast East Texas Field began to reveal its hidden store of cheaply producible and easily refinable, high gravity crude, the entire oil price structure collapsed, and it was then that the leaders of the industry sought help from the Federal Government.

These facts are cited in order to explain why so much refinery construction took place during the years from 1920 to 1930 and why the trend was in the direction of fewer but larger units, and then how in the past four years, although major improvements have continued to be made, this trend has been reversed. As many as 80 small refineries have been built in East Texas in the past four years.

Refining in 1919

Returning to 1919, we see a shortage of coal which permitted a continued favorable market for fuel oil. Railroad transportation remained inadequate for many months following the war and because of the record of trucks established during the war, the industry was ready to accept them for short haul work. In addition, the gasoline demands from the constantly increasing number of automobiles continued to mount so the post-war slump in general business was not seriously felt by refiners throughout 1919 and 1920.

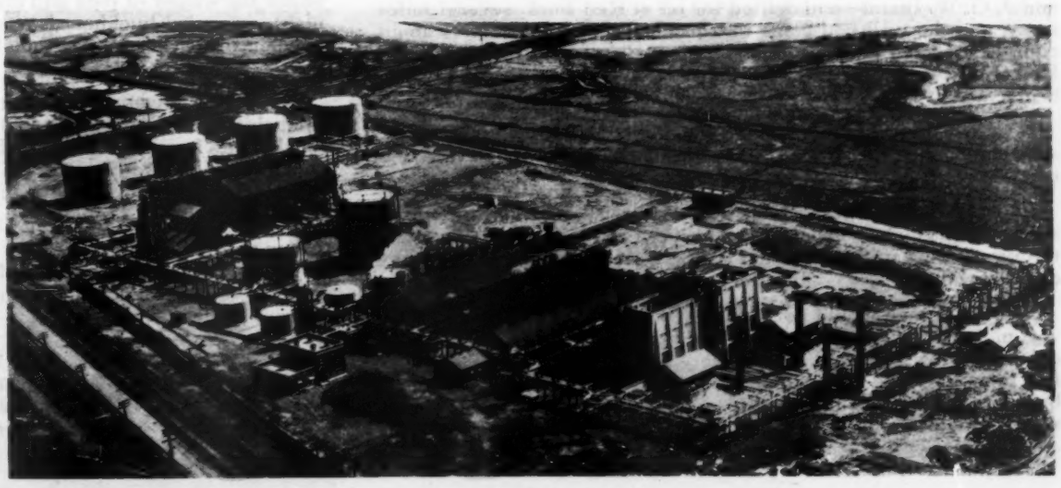
During the years 1921 and 1922, the refining industry felt a little of what economists called the post-war depression. While refined oil prices were generally lower, there was no falling off in oil consumption. The period was marked with business failures among small refining companies, most of which could be accounted for by the overexpansion of facilities during the war or through loss of war contracts which could not be replaced with peace time sales.

Introduction of Ethyl Lead

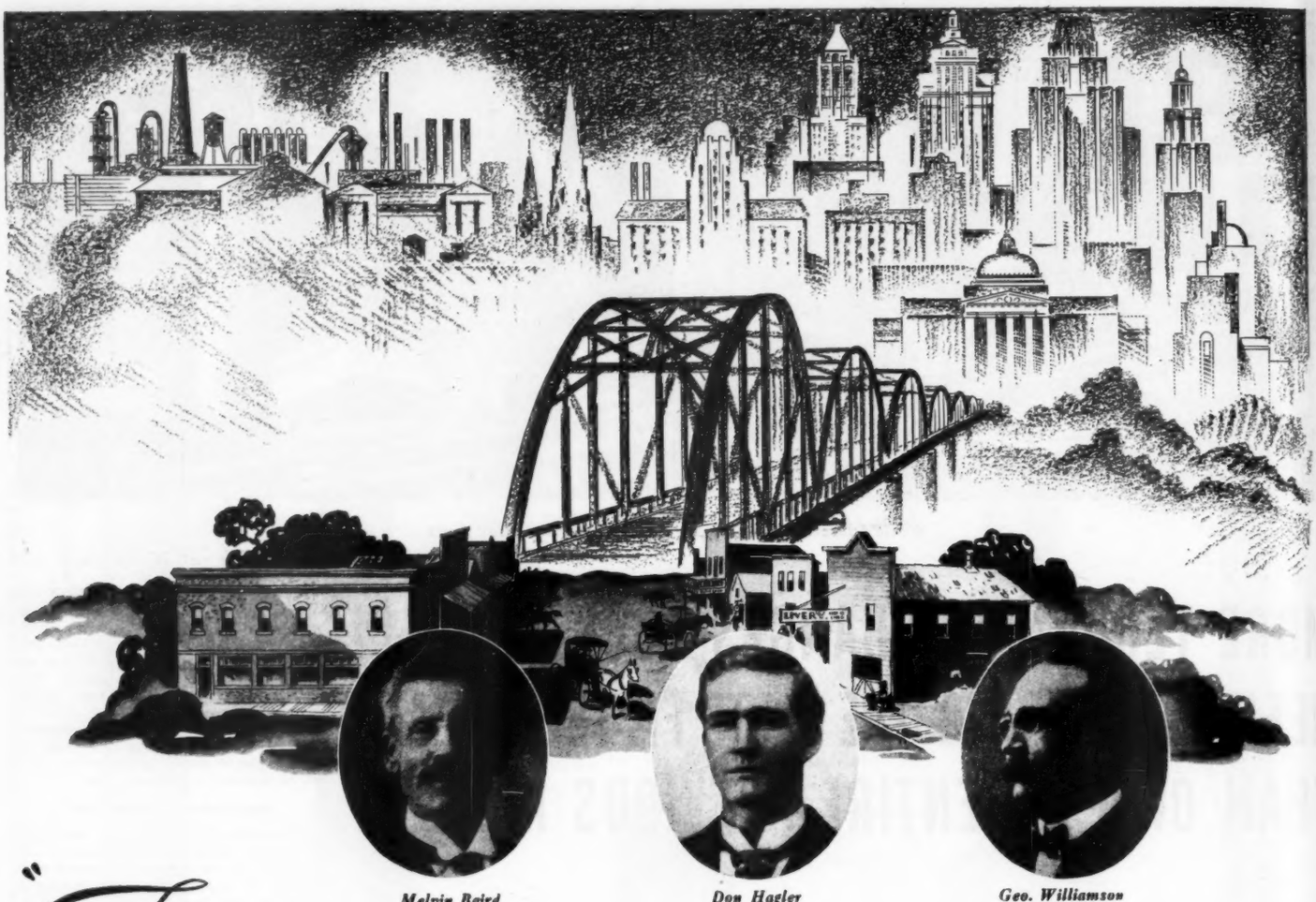
Historically this period is somewhat dull so far as refining developments are concerned, except for one very significant program of research in the laboratories of the General Motors Corp.

It may seem strange that so much influence on the course of refining could come from an outside industry which was not at all competitive with the refining business, but the discovery of tetraethyl lead probably did more in this direction than anything that followed.

On February 1, 1922, ethylized gasoline was first offered for sale. In October of 1923, the General Motors Chemical Co., owner of the rights to sell Ethyl Gasoline, gave an 18 months' contract to the Standard Oil Co. of Indiana and the Refiners Oil Co., granting them the exclusive right to distribute Ethyl Gasoline in 11 midwestern states. The ethyl fluid was to be dis-



An aerial view of the first hydrogenation plant. This is at the Bayway, N. J., refinery of the Standard Oil Co. of New Jersey. The concrete stalls, where the reaction actually takes place may be seen at the extreme right



Melvin Baird *Don Hagler* *Geo. Williamson*

"They said we couldn't do it BUT WE DID!"

There was a time, about 1901, when several small country towns in Eastern Oklahoma were wondering which would be fortunate enough to become supply headquarters for the new Oklahoma oil industry. "Tulsey Town", a dusty crossroads village of somewhat more than a thousand inhabitants, was only one of these and not the largest. Two "country doctors" residing near Tulsa—Fred S. Clinton and J. C. W. Bland—had drilled for oil at Red Fork, several miles away, and the well had come in a producer. Red Fork was about equidistant from several Oklahoma towns, but between Tulsa and Red Fork intervened the Arkansas River—and there was no bridge.

Could a little crossroads town like Tulsa build a $50,000 bridge,—on the chance that this infant oil industry had a real future and that Tulsa could become its base of supplies?

Quite a few of the residents of the village, gathered around the stove at the general store, ridiculed the idea. It was all a preposterous pipe-dream. It was too wild a gamble even if the money could be found.

But three men would not be laughed down. They had a splendid vision, and they refused to relinquish it. They managed to arrange for financing, and the bridge was built, as a private toll bridge,—while doubters still looked on and called them crazy. At the Tulsa end of the new bridge, the builders affixed an iron plate on which were the words, "They said we couldn't do it; but we did!"

The connection was made, between Tulsa's railroad and the budding oil industry. Across the bridge toiled wagons, groaning under the weight of pipe and boilers and drilling engines. Back, at night, streamed buckboards and saddle horses bearing the weary oil men to Tulsa's modest hotels, lunch counters, and amusement places.

Tulsa was given a running start, and she never stopped. She got the habit. The Tulsa Spirit had been born. When the oil industry needed any facility, Tulsa somehow raised the money and was first to provide it. The pioneers builded larger than they dreamed—a bridge from "Tulsey Town," the village—to Tulsa, Oil Capital of the World.

For today the Mid-Continent produces 63% of the nation's oil,—40% of the world's oil—and Tulsa, with its 40 major oil companies and 550 smaller oil and drilling companies—is its acknowledged control point.

Tulsa—Capital of this modern World industry—extends greetings to Titusville—its birthplace—on this memorable occasion—the Diamond Jubilee of the Industry.

TULSA

Oil Capital of the World

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

pensed from individual proportioning pumps or "ethylizers" attached to the service station pump, and the needs of the motorist were to be left somewhat to the judgment of the station operator. As will be seen later, this plan did not prove satisfactory and it was discarded for another, but the introduction of the new motor fuel set refiners to thinking in terms of "antiknock" value in the gasoline they were making. Conditions were ripe for the introduction of many "dopes" and "pep ups" for gasoline. These varied from being mildly beneficial to being harmful to the motor. Research in the development of tetraethyl lead had revealed many antiknock compounds including aniline, benzol, tetraethyl tin, etc., and one or more of these often served as the basis for many of the motor "vitalizers" offered.

One compound which proved popular and which is credited with having been among the first to include a dye was Boycite. When blended with gasoline, it produced a green motor fuel of better antiknock properties. It was on sale some months before the red colored Ethyl Gasoline appeared.

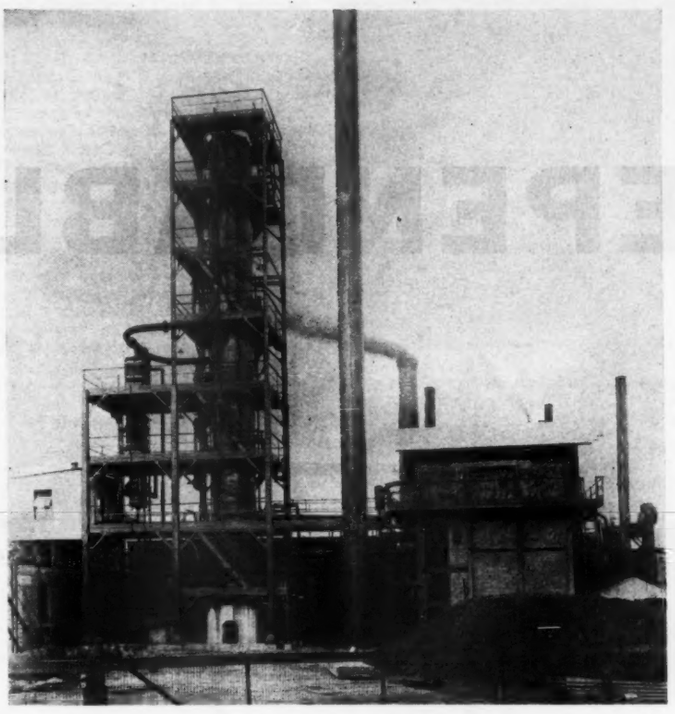
These compounds enjoyed several years of questionable popularity but helped to make the average motorist, the marketer and the refiner "knock minded." This desire to eliminate engine knocking opened up a vast field of research, and both the refining and the automotive industries set about to learn more of the mechanics of "knock suppression" in the motor and the manufacture of better motor fuels.

Develop Knock Test

The inability to express the tendency of a motor to knock when running on a given gasoline made it difficult to compare data. It was realized early in the research program that a standard test was needed, but it was not until 1926 that anything like a standard procedure was worked out.

The first work in this field was done by Ricardo in England. His "highest useful compression ratio" (H.U.C.R.) was that compression in an engine at which knock became perceptible. Other methods soon followed in this country. One was to vary the spark setting for the borderline condition. Many engines were developed among which were the Armstrong, Whitworth, Delco, Liberty and Series 30 of the Ethyl Gasoline Corp.

In October, 1926, a conference was held for the general purpose of discussing existing methods of measuring the knock characteristics of fuel. Representatives of the Bureau of Standards, the General Motors Corp., the Standard Oil Co. of New Jersey, and the Ethyl Gasoline Corp. were present. It was generally agreed that all methods then in use involved comparing the characteristics of two fuels and, since each testing laboratory used an arbitrary reference fuel, no direct comparison of methods could be made without co-operative work on identical samples. It was therefore decided to prepare five samples of widely varying characteristics, and to ask the co-operation of a number of different laboratories in testing these samples by their own individual methods.



The first single-stage distillation unit installed in the Pennsylvania Grade Field. This was built for the Sinclair Refining Co. at Wellsville, N. Y.

The laboratories co-operating in these tests were the Armour Institute of Technology, the Atlantic Refining Co., the Ethyl Gasoline Corp., the General Motors Corp., the Standard Oil Co. of Indiana, the Standard Oil Co. of New Jersey, the Universal Oil Products Co., the fuel laboratory of the chemical engineering department of the University of Michigan, and the U. S. Bureau of Standards. These laboratories were selected largely because of the wide variety of experimental technique represented.

The most important plan for measuring the degree of detonation was that of Dr. Thomas Midgeley. His bouncing pin was so developed that it could be operated and metered by either the gas evolution burette, or the millivoltmeter knockometer. These eliminated the "human element" which impaired most of the other inventions.

Early in the work of picking a standard fuel it was conceded it should be a mixture of two or more pure hydrocarbons closely related to those in gasoline. After much testing and elimination, Dr. Graham Edgar arrived at the mixture of normal heptane and iso-octane. These could be mixed in varying amounts to cover the knocking range of any gasoline.

In October, 1931, the C.F.R. engine was introduced by the Waukesha Motor Co. It represented the combined efforts of technologists in the Bureau of Standards, the automotive industry and the refining industry, who formed the Co-operative Fuel Research Committee. This engine lent itself to a standardization of many operating conditions which was found impossible in other engines. The ultimate result today of these lines of work is the C.F.R. engine operating with a bouncing pin and voltmeter knockometer attachment, and the standard fuel or normal heptane and iso-octane serving as the base.

Method of Manufacture

While the question of motor fuel testing was being worked out, the problem of manufacturing motor fuels which were less likely to detonate was also up for considerable study. There were several means to this end and individual companies chose the one best suited to their needs. Most noticeable was the expansion of liquid phase cracking. This was influenced by the increased quantity of gasoline produced from the crude, rather than solely because cracked gasoline was less likely to knock than straightrun.

Egloff's Prediction

To show the progress in cracking by 1926 such authorities as Dr. Gustav Egloff were thinking in terms of recovering up to 78 per cent gasoline from Mid-Continent crude.

California was relatively slow in adopting cracking, however, because of the favorable fuel oil market. By March, 1926, there were 30 units in the State. These had a combined capacity of only 36,000 bbls., including that which was idle. From this fact the popularity of cracking elsewhere in the country may be judged from a survey made in October, 1926, which follows:

APPLIED METHODS OF CRACKING

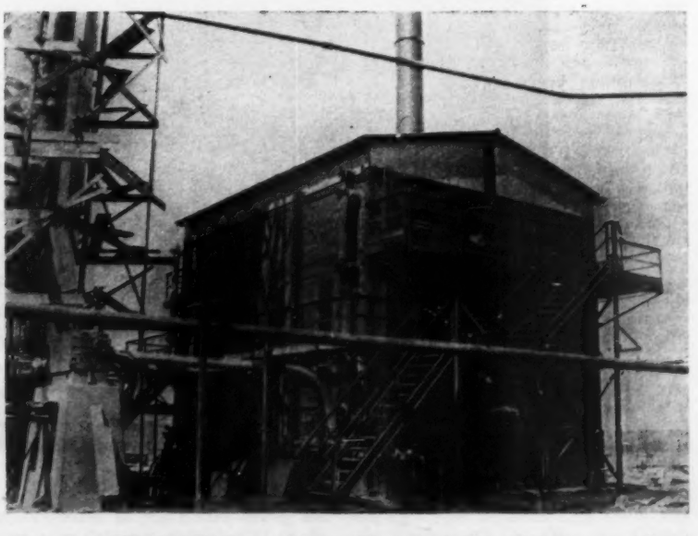
(Capacity of Principal Cracking Processes, October, 1926)

No.	Process	Barrels: Cracking capacity	Barrels: Total capacity
258	Unnamed	.....	1,470,700
32	Burton	344,900	419,050
31	Cross	151,400	196,100
33	Dubbs	131,950	178,900
3	Gulf	125,000	125,000
5	Isom	63,500	63,500
9	Holmes-Manley	63,100	74,000
4	Tube & Tank (Ellis)	50,300	50,300
4	Lewis	33,500	36,500
9	Fleming	29,200	42,700
1	Cosden-Coast	28,000	40,000
1	Black	25,000	25,000
3	Doherty	15,500	15,500
3	Experimental	14,300	42,300
6	Jenkins	11,600	34,900
2	Slagter	11,000	11,000
1	Floyd	4,500	4,500
11	Connerty or Bruin	4,400	5,010
1	Coast	3,000	3,000
1	Chamberlain	2,200	7,800
1	Forward	1,000	2,000
1	Homemade	1,000	1,000
1	Leamon	1,000	1,000
1	Vapor Phase	1,000	30,000
1	Wellman	1,000	5,000
1	Ritchie	500	1,500
1	Tube	500	1,500

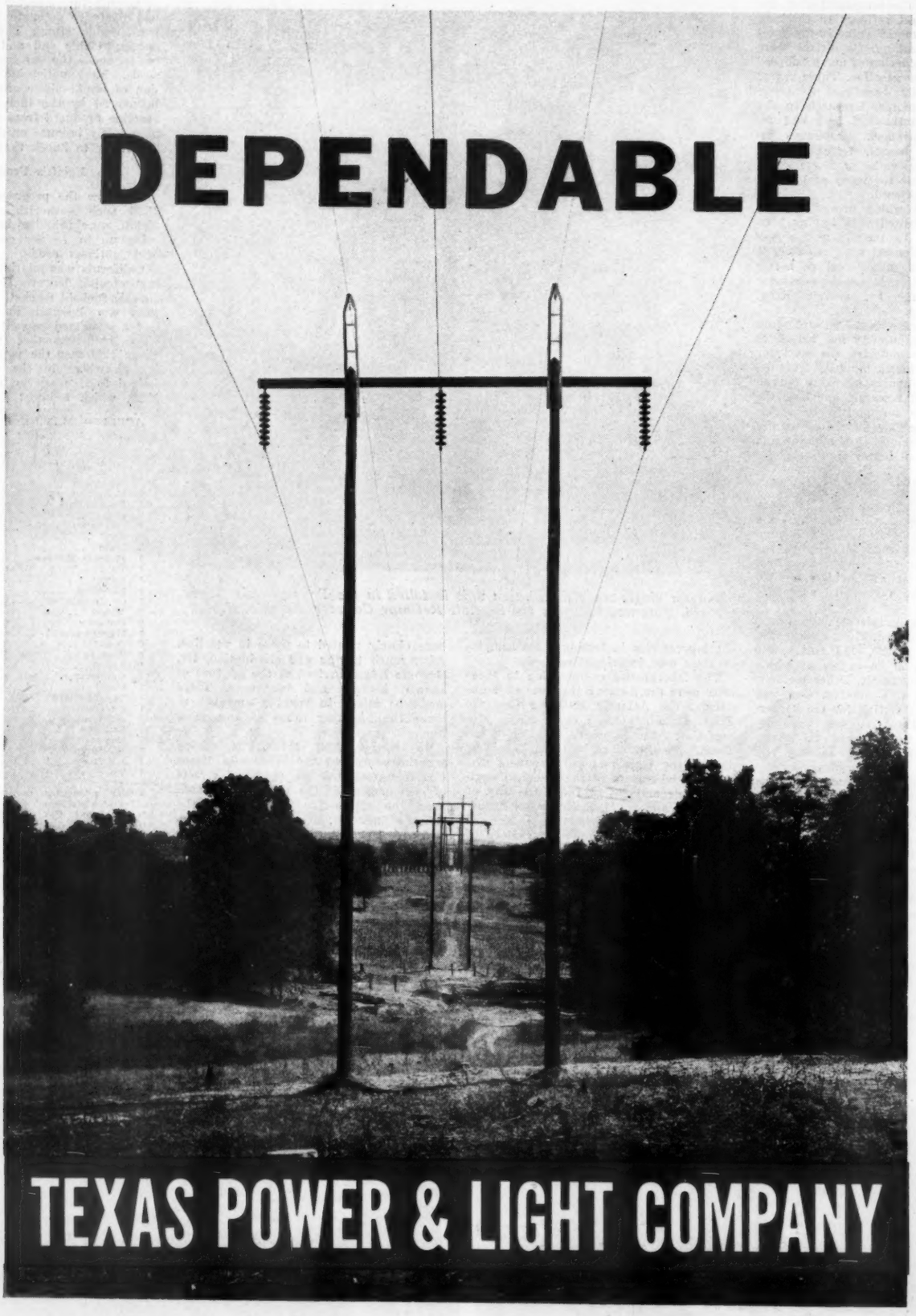
Other processes commercially proposed, used and abandoned or building include McAfee, Lemont, Cyclo, Brown, Kling, Muehl, Ritt-Little, de Florez, Pyro.

What incentive there was in California to crack was due in part to a shortage of natural gasoline. There was a serious shortage of light fractions to balance the increasing volume of high initial straightrun gasoline. California straightrun gaso-

Construction of the first Hortonspheres used in the storage of oil, at the Port Arthur, Tex., refinery of the Texas Co. in 1923



The first Winkler-Koch cracking still to be built. This was completed and tested at the plant of the Rock Island Refining Co. of Duncan, Okla., on March 4, 1928


DEPENDABLE
TEXAS POWER & LIGHT COMPANY

Upon the site of the first Burton cracking units there was built in 1933 a combination skimming and cracking unit which occupies a space that would accommodate only a few of the original Burton stills, but has a capacity to turn out gasoline equal to 470 such stills.

line was inherently a good antiknock gasoline so the desire to improve it did not come from that direction. Some objection was heard in regard to cracking the heavier oils in California due to the large volume of coke which remained in the still and it will be remembered that a solution of the coke problem was suggested in pulverizing and briquetting the coke in an apparatus known as the Fernholtz briquetting machine.

Some idea of the unbalanced sources of motor fuel elsewhere may be seen with western Pennsylvania serving as an example. Here about 68 per cent of the gasoline was straightrun, 29 per cent cracked and only 3 per cent natural gasoline. Straightrun Pennsylvania gasoline is a notoriously bad knocker so it was only natural that the refiners in that area should be interested in cracking units.

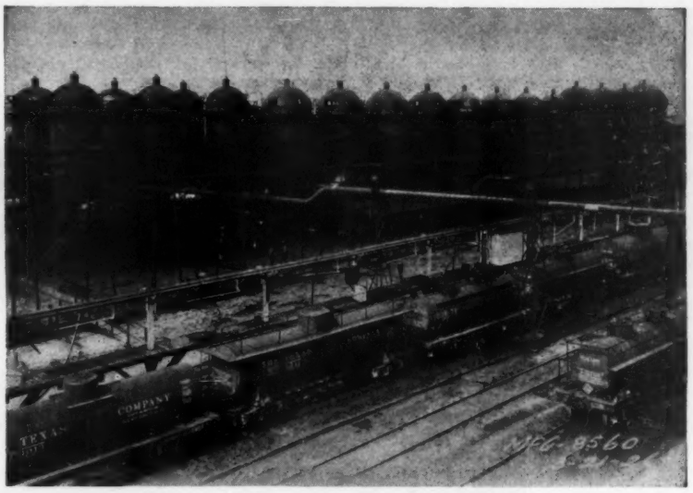
End of Good Prices

Allowing 1926 to serve as a dividing line between the "fat" and "lean" years in the era from 1919 to 1934, it will be necessary to go back to 1919 again to trace developments in refining technique other than in cracking.

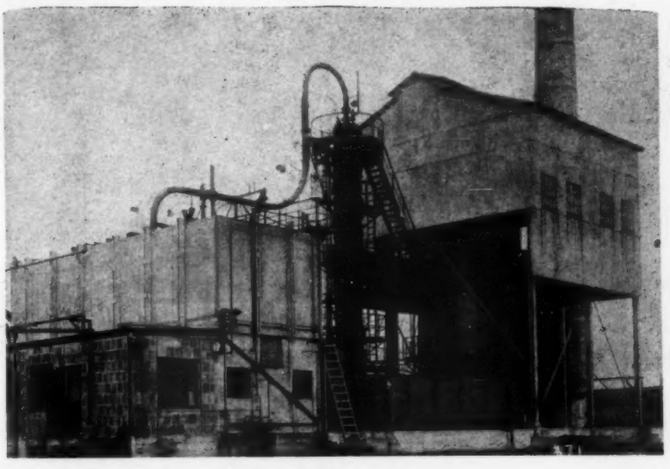
With the introduction of the Trumble process in a number of California refineries, greater attention was paid by the industry to improvements which led to operating economies. About 1920 the larger refiners began to study the practices in other industries, notably in the manufacture of alcohol and in the refining of benzol, for a clue to the solution of fractionation in the refining business. One of the first proposals was the use of sieves as plates in a tower. Clay rings, iron turnings, crocks, rocks and perforated steel plates all served as packing for experimental towers. These were gradually abandoned, however, in favor of the bubble tower on which the industry has generally standardized. It is of historical interest to know that Herman Frasch was familiar with this type of tower and that it had been used in Germany for the refining of cleaners' naphtha before 1875.

In the development of fractionating equipment those who figured most prominently in the early work included Prof. W. K. Lewis of the Massachusetts Institute of Technology; Clark S. Robinson of the same institution; W. A. Peters, Jr., of the E. B. Badger & Sons Co.; Prof. E. H. Leslie of the University of Michigan; R. E. Wilson of the Standard Oil Co. of Indiana; W. C. Koehler; N. E. Lummus of the Standard Oil Development Co.; C. J. von Bibra of the General Petroleum Corp., and J. M. Wadsworth.

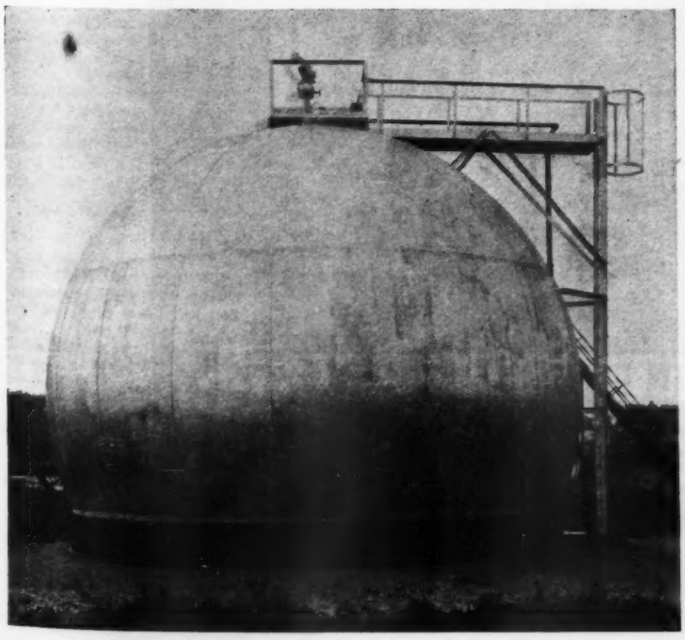
The favorable results secured in the fractionation of straightrun gasoline encouraged the design of towers which would permit finishing cracked gasoline direct from the unit. This pretty well worked out, the next step was to treat the cracked gasoline in the vapor state so as to produce a finished cracked gasoline with respect to color and gum content, as well as distillation characteristics. This was accomplished by use of the Gray vapor phase treating unit, introduced in commercial size in October, 1924. The treater was installed at the plant of the Barnsdall Refining Co. in Barnsdall, Okla., and it finished about 300 bbls. of cracked gasoline daily.



One of the largest installations of agitators in operation at the Port Arthur, Tex., refinery of the Texas Co. These agitators are all used in the manufacture of lubricating oils



First commercial installation of the de Florez process in the Bayonne plant of Gulf Refining Co. in 1928



The first commercial Hortonspheroid at the plant of the Sinclair Refining Co. at Wellsville, N. Y.

As early as 1913 Thomas T. Gray of Elizabeth, N. J., had discovered that if gasoline in the vapor phase were brought into contact with fuller's earth the tendency for the gasoline to develop color and deposit gums was removed. A selective polymerization took place whereby the polymerized product separated out as a higher boiling liquid, leaving the gasoline vapor in a stable, refined condition. A patent was granted on this process in 1920 (U. S. Patent 1,340,889), but it was not until 1924 that the laboratory method was translated to a large scale commercial production at Barnsdall.

The problem of maintaining color became serious as the percentage of cracked gasoline increased. A few refiners considered the use of dyes to cover up any discoloration that might take place. They realized that certain desirable hydrocarbons would be removed if the gasoline were chemically treated heavily enough to eliminate this discoloration.

The first important deviation from the old acid and doctoring treatment of gasoline came in the spring of 1921 when sodium hypochlorite was brought into prominence. The treatment was developed in England under Dr. A. E. Dunstan, chief chemist for the Anglo-Persian Oil Co., Ltd. Patent rights were secured by the Mathieson Alkali Works of material manufactured in the United States and that company was instrumental in designing plants suitable for use of the chemicals.

An important phase of refining which has not been touched upon so far is the manufacture of lubricants.

From the day the owners of cotton mills along the Atlantic Coast first blended Pennsylvania crude oil with sperm oil to lubricate their machinery to the present day of scientifically compounded lubricants many changes have taken place. Because of the need for industrial lubricants in the western states and because Pennsylvania grade crude oil possessed certain inherent qualities that permitted it to be processed to make superior oils, it is natural that much of the progress in manufacturing motor oils and industrial lubricants should be bound up in the history of early refining in Pennsylvania. Avoiding details in this brief story of progress mention should be made of the successful application of vacuum distillation, contact filtration and the use of California acid treated clays.

In 1920 the first high vacuum (3 to 7 mm. mercury absolute) was used. Much of the design was based upon work done by the Vacuum Oil Co. which had installed its first vacuum unit at Rochester in 1866. It was designed by Hiram Everest and had a capacity of 30 bbls.

Among the first high vacuum processes to be used was the Schulze, for which a patent was issued in March, 1923. It operated under a vacuum of 29.9 inches of mercury and an oil temperature of 630° F. The first units were installed in the Houston plant of the Deepwater Oil Refineries, Inc., and the Red River Refining Co.'s plant, near Chicago.

In the more recent years vacuum distillation has been expanded to include the overhead processing of bright stocks and pressure distillates and where indirect heating was found advantageous use has been made of diphenyl and mercury vapor as the heating medium. The Indian Refining Co. plant at Lawrenceville, Ill., now owned by the Texas Co., utilized diphenyl in manufacturing lubricants by the Govers process and the Sun Oil Co. perfected the use of mercury vapor as a heating medium.

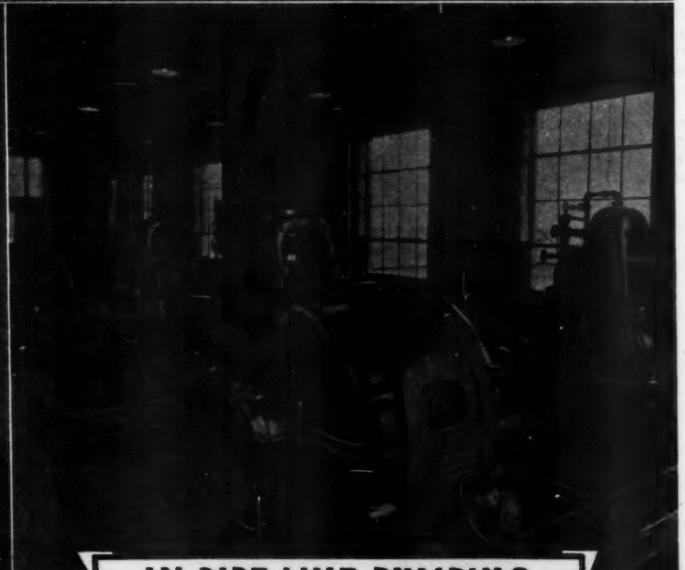
Sharples Process

The improvement in vacuum distillation of lubricating oil called for improvements in dewaxing and mention should be made here of the introduction of the Sharples process. This was developed in the laboratories of the Sharples Specialty Co. at West Chester, Pa. The first installation of centrifuges was made in the Bradford, Pa., plant of the Kendall Refining Co. Production of centrifuged, dewaxed lubricants started early in 1920. At the same time units were being made ready for operation in the Mariand Refining Co.'s plant at Ponca City, Okla., now the Continental Oil Co.; the Casper, Wyo., plant of the Midwest Refining Co.; the Chanute, Kans., plant of the Mutual

THE TREND IS TOWARD PURCHASED ELECTRIC POWER

··IN REFINING··

··IN WELL PUMPING··



··IN PIPE LINE PUMPING··

TEXAS ELECTRIC SERVICE COMPANY

General Offices: FORT WORTH

Oil Co.; the Oil City plant of the Pennzoil Co. and at the Port Arthur refinery of the Texas Co. Since that time the process has been quite universally established. In all, about 65 plants have been put into commercial operation.

Contact Filtration

The process of contact filtration had long been in use in the refining of vegetable oils when it was finally adopted in lubricating oil manufacture. Different clays were brought into use; bentonites from California, and diatomaceous earths from various parts of the West. One of the first commercially prepared acid treated California clays was marketed under the name of "Filtrol." The first ton of Filtrol was shipped to the Vacuum Oil Co. at Paulsboro, N. J. The first carload shipped to any refiner was 30 tons sent in September. 1926, to the Mid-Continent Petroleum Corp. of Tulsa. The first to employ the process of contact filtration were the General Petroleum Co. and the Standard Oil Co. of California, both located on the Pacific Coast.

Grease Making

Hand in hand with developments in lubrication have come improvements in grease making. The manufacture of the first grease followed closely after the discovery of oil in Pennsylvania. It was made by mixing crude petroleum, rosin and lime water. Improvements came slowly until the adoption of the steam heated, closed type pressure kettles in 1928. This new method cut the time of cooking considerably and produced a much smoother grease. In 1928 lead greases were introduced.

Panhandle Boom

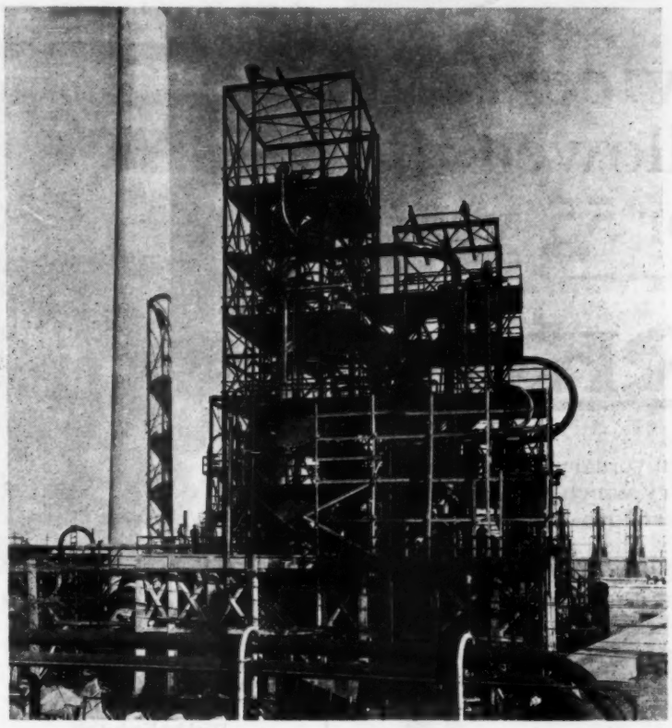
While refiners generally were interested in the subjects of cracking, improved fractionation, automatic control, contact filtration, etc., a new field was being opened to those who wished to follow "booms." The Panhandle of Texas was beginning to witness a typical oil boom. The refiners who went there with the idea of building refineries, however, saw they were faced with new problems in processing that particular crude. As the oil was produced, it contained a high percentage of sulphur and sulphurous compounds that broke down on distillation to produce corrosive vapors.

The straightrun gasoline had to be treated heavily with acid and doctor, and was generally more costly to manufacture. Freight rate differentials were against Panhandle refineries on shipments going into a greater part of the middlewestern territory, so that all in all the principal inducement for refiners to locate there was the cheap crude which this field offered.

An important contribution of the Panhandle development was the Rowsey Process for the recovery of litharge, through oxidation of the spent sludge by blowing it with air while holding the temperature of the sludge above 100° F.

Resume Ethyl Sales

Several years had passed since the introduction of tetraethyl lead when in April, 1925, due to the loss of several lives from poisoning, its use in gasoline was voluntarily discontinued. An investigation by the Surgeon General of the United States was immediately started and he was asked to formulate recommendations regardling its safe handling. This he did approximately one year later and in the meantime General Motors Chemical Co., which company developed tetraethyl lead, joined with Standard Oil Co. of New Jersey to form the present Ethyl Gasoline Corp. It will be remembered that the General Motors Chemical Co. had contracted with the Standard of Indiana for the latter's exclusive sale of ethylized gasoline in 10 middlewestern states for a period of 18 months. During the term of the contract difficulties had been witnessed in delivering mixing devices for in those days the fluid was metered and injected into the gasoline stream at the filling station. This practice introduced hazards, which delayed its marketing and when a halt was called on the sale of the gasoline in 1925, an understanding was reached between the Ethyl Gasoline Corp. and the Standard Oil Co. of Indiana, that the latter company would retain exclusive right to the sale of this product throughout the same states until March 29, 1926. In this manner a damage suit was avoided.



Two Foster Wheeler tube stills in the Ponca City, Okla., plant of the Marland Refining Co. (Continental) equipped with fractionating towers having a total capacity of 18,000 bbls. of crude per day. This unit was quite an innovation in the Mid-Continent area when it was completed

Hard Times Ahead

While the Mid-Continent industry was obligated to absorb an increasing flow of crude oil from the Seminole and Panhandle fields, it became apparent that the price structure on refined products was being weakened. Producers and refiners foresaw strained conditions ahead, but found they were unable to act collectively without fear of violating the Sherman antitrust law.

In the latter part of 1926, Herbert Hoover, then Secretary of Commerce, realized the plight of the industry, and in an interview in Tulsa said he would favor a revision of the antitrust law to permit planning and control of production. For the moment this statement offered encouragement, but sufficient momentum could not be supplied outside of the oil states to actually bring about a change in the law.

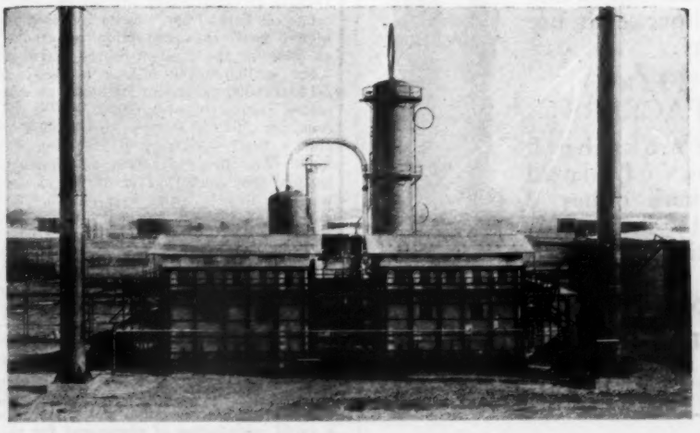
It did, however, encourage oil executives, sales managers, etc., to discuss marketing problems which they were afraid to do before. They were approaching a better understanding of each other's desires, but they did not avoid a collapse in the market in 1927.

Fail to Control Production

It was at this point in the 15-year era that the oil business realized it was faced with an oversupply of crude and that the future problem would be to convert this into finished products in order to move it quickly. The profits of yesteryears were turned back into refining and marketing facilities in an effort to gain a more strategic position. It was the beginning of that ruinous period in which progress was measured in gallons and not profits.

Tremendous investments in refinery equipment were made in the years 1927 to 1930. Developments soon covered such a large front that a greater share of the new problems of design and construction fell into the hands of equipment companies for solution. They applied the most exacting design and specifications to the job to be handled. Acceptance of the finished equipment was generally based upon meeting certain guarantees in quality in the finished oil.

While expansion programs continued especially on the part of those companies which had realized a full share of profits in the previous years, there was a noticeable turn in the methods of design and operation of new equipment to indicate that economy was becoming a definite factor. Fuel economizers, particularly flue gas recirculating systems, were generally adopted. There was a more generous acceptance of recording devices, meters, and instruments of all kinds as a means of checking up on possible losses.



The first Winkler-Koch combined "pressure" and "vapor phase" cracking still. This was built for the Magnolia Petroleum Co. in 1930 at its Luling, Texas, plant

Hydrogenation

While every possible application of technology was being called upon to improve oil quality with the hope of expanding markets, the refining industry was brought one step nearer to becoming a truly chemical manufacturing undertaking when the commercial hydrogenation of oil became a reality in 1928.

Hydrogenation was first discovered in 1871-72 by Berthelot. His work was on hydrocarbons of coal and fatty oils. The first practical process was introduced in 1913 by Bergius, who hydrogenated coal and oil. Commercial hydrogenation was first introduced in America in 1927, when the Standard Oil Co. of New Jersey effected a working arrangement with the I. G. Farbenindustrie of Germany. The first plant to operate in America was built at Baton Rouge, La., in 1928. It was a semi-commercial plant; first having a one-half barrel per day capacity, and then enlarged to the size of a pilot plant. The first full scale plant was completed at Bayway, N. J., in August of 1930. It had a capacity of 5,000 bbls. Similar units were then built at Baton Rouge, La., for the Standard Oil Co. of Louisiana and for the Humble Oil & Refining Co. at Baytown, Texas. Although no other plants have been built, the commercial application of hydrogenation has progressed in these plants to prove its practicability. The commercial production of hydrogenated motor fuels of exceptionally high octane number has been supplemented by "safety" fuels and hydrogenated lubricants of especially high viscosity indexes.

Gyro Cracking Process

Early in 1927 another important development in refining was announced by the Pure Oil Co. It had sensed the growing popularity of gasolines of high antiknock value and several years before had interested itself along with Detroit capitalists in a vapor phase cracking unit. In describing the unit, R. C. Osterstrom of the Pure Oil Co. said it would carry the name Gyro and that a plant was ready to operate in the Pure Oil Co. refinery at Cabin Creek, W. Va. Early in 1928 that unit produced gasoline which equaled benzol in antiknock value. Since that day it is common knowledge that the high losses of fixed gases which the unit first showed have been reduced in those of later design, more particularly since augmenting the operation with a polymerization unit. Difficulty was witnessed at first in treating the gasoline to remove the large gum content and it was at this point that the industry was presented with a new major problem.

Gum Problems

The practice of cracking under more severe conditions in all types of units induced the formation of more gum in motor fuels and with the introduction of vapor phase gasoline, chemists settled down to a detailed study of the treating problems involved. Various gum tests were introduced including those which differentiated between preformed and totaled gum.

After a year of low prices during 1927 refiners were seeking changes that would reduce their operating costs. They were

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more concerned about the initial investment in equipment and throughout 1928 were making changes that would result in lowering the cost of operation. These included improved vapor recovery plants, pressure tankage, improved burners under the stills and boilers, complete insulation of steam lines, and a greatly extended use of instruments and automatic control devices.

In that year two popular types of cracking units were introduced.

Winkler-Koch Unit

On March 4, 1928, the first Winkler-Koch cracking unit was tested in the Duncan, Okla., plant of the Rock Island Refining Co. In later years, this unit proved unusually popular throughout the Mid-Continent area.

de Florez Unit

In that same year, Luis de Florez completed his experimental work on the cracking heater that bears his name. The work had been carried out jointly by the Texas Co. and the Gulf Refining Co. with Luis de Florez. The first commercial installation was made about 1928 in the Bayonne, N. J., plant of the Gulf Refining Co. under the direction of Mr. de Florez, and represented the culmination of research work conducted over a number of years. The process was distinctive in its manner of supplying the heat for cracking. The stock circulating through the heater was a clean distilled stock prepared within the system, which was suitable for cracking at high temperatures without coking.

The years 1928 and 1929 showed advances in the general art of cracking. Despite the continuing overproduction of crude oil beyond the volume required for higher uses, the production of cracked gasoline in the United States increased from 4,250,000,000 gallons in 1927 to 5,140,000,000 gallons in 1928 and an estimated volume of over 6,000,000,000 gallons for 1929. During this period of time a further shifting of attention was noted from the production of maximum gasoline yields to that of antiknock motor fuel, together with by-products, such as cracked fuel oil, furnace oil, gas and coke.

Advance in combating corrosion was made by lining reaction chambers with cementitious material, the use of alloy steels, chromium plating and the injection of chemicals.

After more than a year of declining operating margins, refiners watched for every possible saving that could be effected. They were quick to install continuous treating systems, and there was a rapid installation of equipment for the recovery of litharge. Even the smaller plants installed acid recovery units and other changes included better boiler house practices, water cooled and air cooled boiler and still settings.

Metallurgy was showing substantial advances in the direction of supplying acid resisting and heat resisting steels.

In those instances where new equipment was installed, the general practice throughout 1928 and 1929 was to provide for a wide range of flexibility in order to take advantage of changes in market values on the products.

Centrifuge room at the Port Arthur, Tex., refinery of the Texas Co.

Low Cold Test Lubricants

One of the most important general changes was the prominence given to the manufacture of low cold test lubricants. Thought was given to direct expansion of ammonia in suitable chillers in contrast with the older practice of passing the oil countercurrent to cold brine.

First Commercial Synthetic Lubricant

The first commercial synthetic lubricating oil was produced by the Standard Oil Co. (Indiana) in January, 1929. The product was superior in many respects to the best natural lubricating oils and has found a wide market for special uses requiring an extremely high quality oil. The process, in brief, is to crack a selected wax, polymerize the resulting olefinic hydrocarbons with aluminum chloride and distil the polymerization product to the desired viscosity.

The octane race was still in its infancy but was given impetus on April 1, 1929, upon the termination of the contract between the Standard Oil Co. (Indiana) and the Ethyl Gasoline Corp which provided for exclusive sale of ethylized gasoline by the Standard of Indiana throughout 10 states in the Middle West. By that time 50 companies were licensees of the Ethyl company and the opening up of the Standard Oil Co. (Indiana) territory encouraged others to become licensees.

Debutanizing

Another means refiners adopted to improve the antiknock value of their motor fuels and at the same time reduce evaporation losses was to conserve all light fractions. The Humble Oil & Refining Co. introduced the practice of debutanizing early in 1929 at its Houston, Tex., refinery. The scheme provided for removing the very light fractions from the crude by first passing it through heat exchangers. These fractions were stored in the pressure tankage and the main bulk of the crude was then processed in regular manner, without the customary evaporation losses occurring with handling. This idea was expanded and adopted for use in debutanizing pressure distillates, also. This was made possible through the improved design of several new types of pressure tankage with much

credit due to the Chicago Bridge & Iron Works.

Reforming

In 1931, the refining industry adopted a new term, namely, "reforming." This term was adopted for the practice of cracking straightrun naphthas in order to produce a motor fuel of higher octane value.

Early in that year the Standard Oil Co. of Ohio announced that it had converted a Tube and Tank unit over to a reforming operation and was making a 70 octane gasoline by this method at its Cleveland plant. While other refiners expressed mixed opinions regarding the economies of the operation they admitted there was a growing need for some sort of equipment to arrive at this same end.

Introduction of "Paraflow"

During the year, there was comparatively little change made in the methods of manufacturing lubricating oils and the rush to install the equipment to reduce the cold test of motor oils was dampened somewhat by the introduction of "Paraflow," a product of the laboratories of the Standard Oil Co. of New Jersey. This material depressed the cold test of the oil by holding the wax in solution.

More months of low gasoline prices followed, with market competition becoming more severe. Refiners were resorting to every means of improving the octane number of their gasoline at a minimum cost.

Combination Units

The Standard Oil Co. of Indiana met this new need in its Whiting plant by building the largest combination skimming and cracking unit in the world. By the middle of 1932 it had completed a 20,000-bbl. unit which was turning out 70 per cent gasoline of 70 octane number.

Combination skimming and cracking, combination "pressure" cracking and "reforming" and other so called combination units were installed in a number of plants where replacements were found necessary. In most cases, they did not add to the crude capacity of the refineries.

In that same year the need for gum inhibitors was more keenly felt and a broad program for research was instituted, the Pure Oil Co., the Universal Oil Products Co. and the Standard Oil Co. of Indiana taking a leading part.

While this improvement was taking place in methods of distillation, there was an equally important development taking place in regard to the chemical treatment of products.

Zinc Chloride Process

The successful treatment of cracked gasoline in the vapor phase with zinc chloride solution is credited to Arthur Lachman of the University of California. The first patent taken out on this process was dated January 27, 1931. The first plant to apply it commercially was that of the Richfield Oil Co. The first Mid-Continent refiner to adopt it was the Globe Oil & Refining Co. in the first half of 1933.

Higher Octane Values

The continued trend during 1933 was toward higher octane number motor fuel. Reforming became especially important in satisfying this quality demand and continued to aid in raising the average octane number of gasolines on the market. This average octane rating was increased from 65 in 1932 to 69 in 1933. Divided into individual grades of gasoline, the rise was from 74 to 76 for the average of the premium grade, from 61 to 65 for the regular grade, and 51 to 53 for third grade gasoline. Coincident with this sharp increase, and made possible by it, was the continued increase in compression ratios of new automobiles. The average ratio has increased from 4.96 in 1931, to 5.50 in 1932, 5.59 in 1933, and 6.1 in the 1934 models. These averages are claimed to represent about 90 per cent of the cars sold during each year.

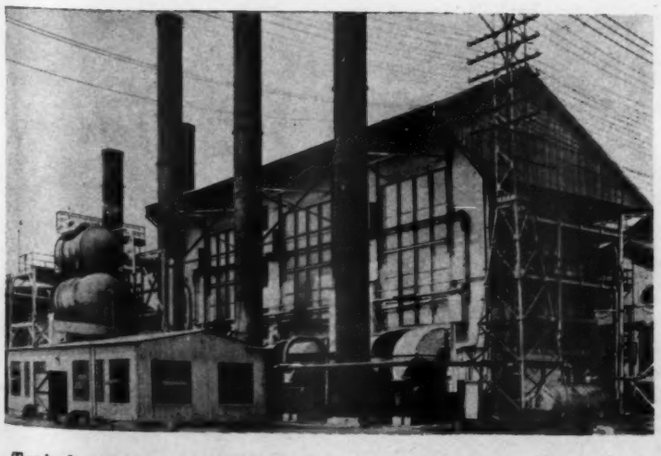
Increased octane number has been accompanied by increasing volatility and vapor pressure in the 1934 motor fuels.

The tendency to produce these high octane motor fuels by reforming straightrun gasoline, so popular early in 1933, was dampened on June 1 when the Ethyl Gasoline Corp. offered its "Q" fluid for the ethylizing of a second grade or house brand of motor fuel. Under a licensing arrangement this fluid was to be handled in much the same manner as Ethyl fluid except that the ethylized "Q" gasoline was not to have an octane number higher than 70. This had the effect of stopping the octane race and many of the reforming units built in 1932 and 1933 were revamped for ordinary liquid phase cracking.

Solvent Extraction

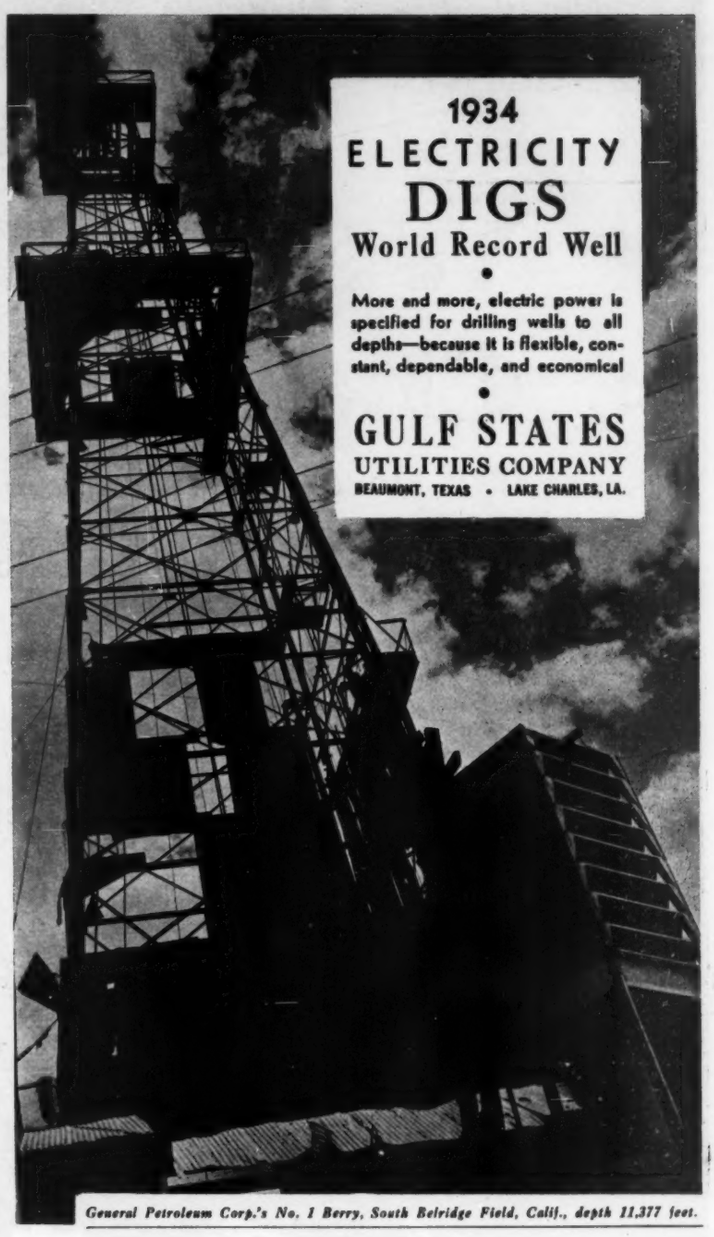
The greatest recent development in the manufacture of lubricating oil is the application of solvent extraction. Although not entirely new in the industry, this process is being rapidly expanded by the larger units. The principle was first employed on a large scale by the Indian Refining Co., of Lawrenceville, Ill. This company used a combination of benzol and acetone. Another early process is that of Edeleanu, having been used in kerosene for many years.

The more important of these solvents and the concerns which have adopted them are as follows: Dichloroethyl ether (Chlorex), Standard Oil Co. (Indiana), Mid-Continent Petroleum Corp.; furfural, Texas Co.; propane-cresylic acid (Duo-Sol), Gulf Refining Co., Socony-Vacuum Corp., Magnolia Petroleum Co.; sulphuric acid-benzol (Edeleanu) Union Oil Co., Shell Oil Co. of California; phenol, Imperial Oil Co., Ltd., Standard Oil Co. of New Jersey, Standard Oil Co. of Louisiana, Humble Oil & Refining Co., nitrobenzene, Atlantic Refining Co., Sinclair Refining Co.



Typical refinery power and steam plant of the most modern construction. The above is a picture of a recently completed unit at the Bayonne, N. J., refinery of the Tide Water Oil Co.

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.



General Petroleum Corp.'s No. 1 Berry, South Belridge Field, Calif., depth 11,377 feet.

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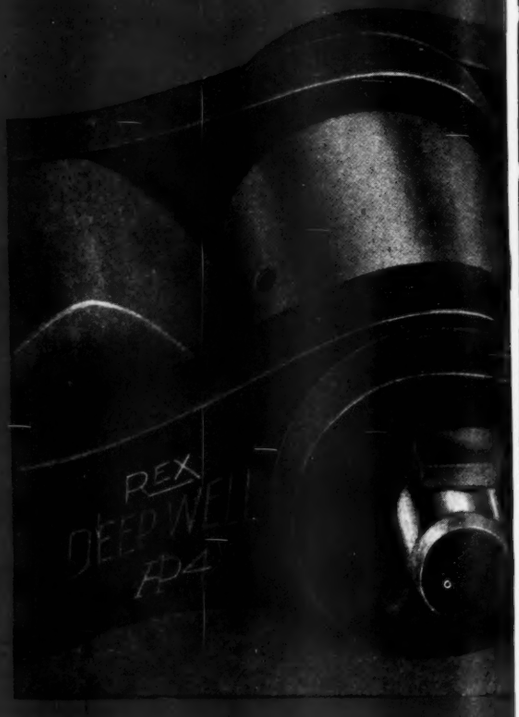

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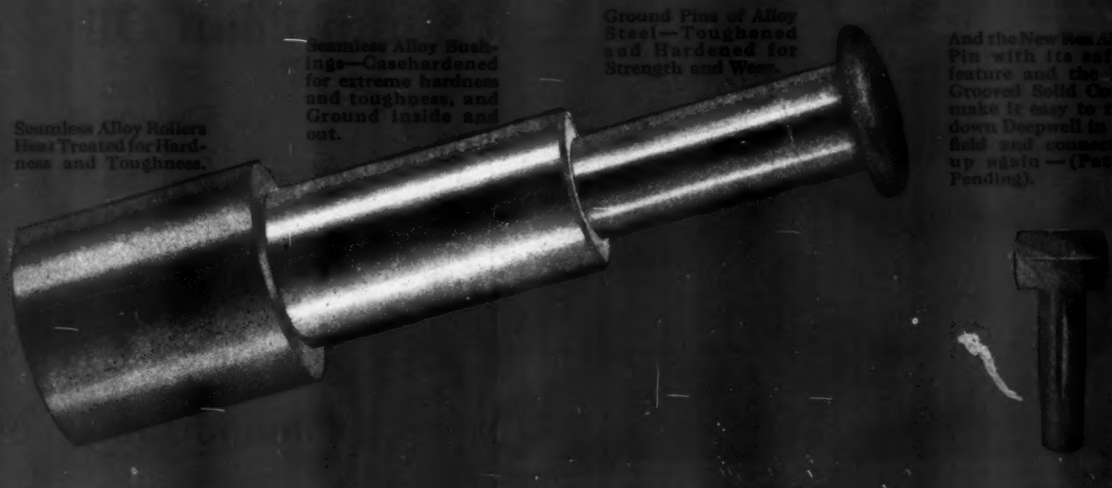
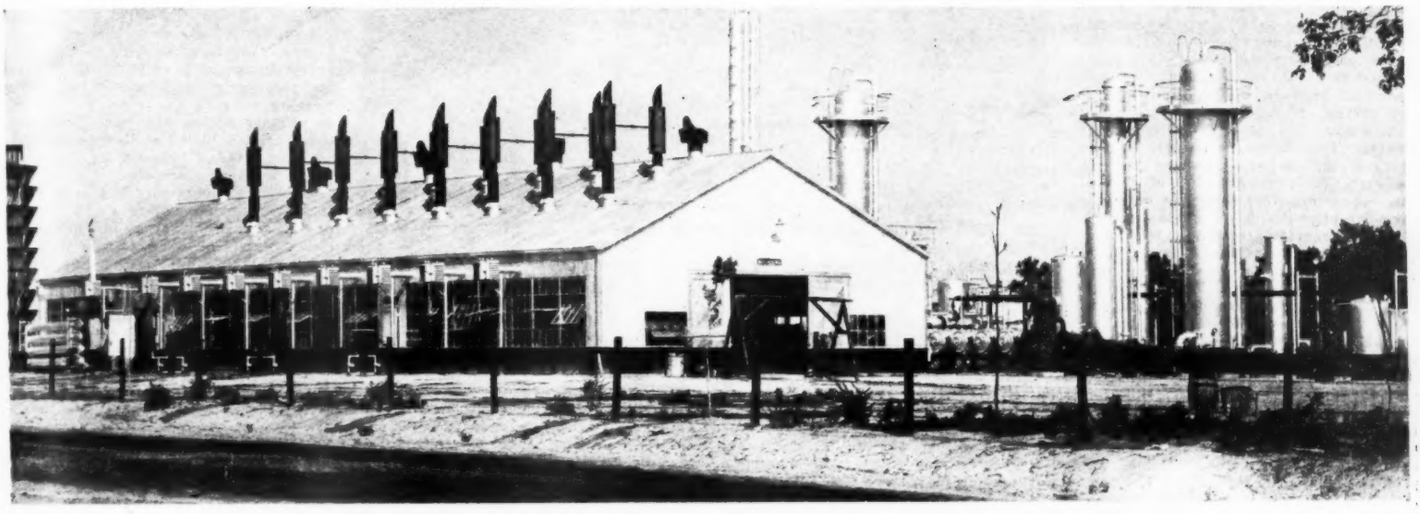


NATURAL GASOLINE—1919-1934

RESEARCH MADE NATURAL GASOLINE NEW FACTOR IN MOTOR FUEL MARKET

Impetus was given the building of absorption plants for the recovery of natural gasoline by the decision of the Federal courts in refusing to sustain the patent rights claimed by the Hope Natural Gas Co. and in the years beginning with 1919 and through 1924 hundreds of such plants were built wherever new gas fields were discovered. Probably the most important piece of individual equipment in the absorption plant to undergo improvement along with the hurried installation of these units in the early days was the bubble cap tower. Its use was not new to the petroleum industry for fractionation but in natural gasoline plants its first application was in towers for the contacting of the gas and oil for absorption of the vapors. It replaced the crock packed towers of the earlier days and not only simplified the unit but brought down its cost. In 1927 a froth type of plate was introduced which improved the efficiency of the average tower using the method. It soon followed that benefits accrued through the use of pressure towers in which the volume of gas was reduced and the tendency for the vapors to liquefy.



Humble Oil & Refining Co.'s new natural gasoline plant in the Conroe Field of Texas

Still Design

The character of the products of a gasoline plant is directly influenced more by the type of fractionating equipment than by any other major unit. This has been graphically shown in the development of the last 15 years. Hand in hand with the evolution of better absorption methods came the finer control and increased efficiency of new distillation units. In the early days of the industry, little attention was paid to the composition of the natural gasoline produced. The endpoint and gravity were practically the only criteria used. However, changing conditions in the market came to demand a gasoline of a more homogeneous nature. The result was the adoption of improved distillation equipment. The old direct fired stills gave way to steam stills and fractionation towers of the bubble type were installed and improved upon. Steam was used in direct contact with the rich oil, entering the column at the bottom and contacting the exhausting stream. Better control at the top of the tower was effected by refluxing the condensate.

Stabilizers

Finally in 1930 the stabilizer made its appearance. It comprised a very efficient rectifying column with a "kettle" or reboiler at the bottom. It answered the objection refiners were making against the purchase of natural which caused vapor locking when blended with their product to make motor fuels.

Although the progress in this industry is measured by the refinement of such major pieces of equipment as the absorber and still, the development of auxiliary equipment was of no small importance. In fact the greatest improvement in the last few years has been in temperature and pressure regulation and pumping equipment. With the trend toward large installations, the application of power became a problem. Some operators continued to enlarge the main shaft of the prime mover. Others abandoned this practice and installed electrical units with a steam driven generator for the source. Still others applied the steam directly through the plant in turbines. These last practices adapted themselves very well to the centrifugal type of pump which was adopted almost completely by the beginning of 1931. This is due to its compactness and susceptibility to automatic control. The very recent introduction of splash-proof electric motors strengthens the place of electricity in the plant setup.

Closely following the innovations in the refining industry, the natural gasoline industry adopted a vast yet closely coordinated system of automatic pressure and temperature controls. Thermocouples and other devices were placed at the delicate points in the processes and by electrical means controlled fuel consumption, steam injection, feed flows and reflux streams to hold these points at constant conditions. By 1933 the gasoline plant became almost automatic in its operation.

Gas Testers

In 1920, with the beginning of smaller profit margins, the natural gasoline manufacturer began to look to economy in operation of his plants. In the planning of new plants precautionary measures were adopted. The fields were studied as to length of life, pressure trends, and quality of the gas. A great aid in this survey came with the invention of gas testers. Reliable apparatus was adopted which would test accurately the amounts of different hydrocarbons in a gas. Air testers also were used by this time to test for leaks in gathering systems. With the information gained by these instruments the manufacturer built his plants with more assurance. The uncertainty of many fields from the standpoint of permanence caused a growth of so-called "portable" gasoline plants. These plants were first introduced in California and later spread to the Mid-Continent. They were thrown up without the permanent fixtures necessary in a well-planned setup. They therefore operated at a very low efficiency and profited only by using the wet gas of high pressure fields. These plants saw their height about 1926 and then dwindled as the trend passed to larger and fewer units.

Typical underground storage tanks used in early days to minimize evaporation losses on natural gasoline

The auxiliary equipment which the portable plants lacked was just the type that was being used more and more by the large companies, namely preheaters, heat exchangers, feed water treaters, etc. Fuel had always been considered an unimportant item in natural gasoline manufacture. However, when the need for economy became evident, the heat from the stills was exchanged to the rich oil going to the still, and to the boiler feed water. Systems for cooling the lean oil were improved decidedly in 1927. Experiments were made with closed type coolers of the heat exchanger type. However, the expensive removal of the scale which formed in them prohibited their general acceptance. The open type tower which is in general use today was improved in 1927 to some extent. The velocity of the spray was increased to prevent excessive algae growth and the tubes were staggered to make for more effective wetted surface. The latest improvement is the use of many turns and bends in the tubes. The temperature changes and resulting expansion and contraction of the pipes keep them free of scale formation. In 1931 feed water treatment systems found their way into practice. With treatment of all water used in the plant boilers and coolers, the losses due to corrosion and scale formation were decidedly lessened.

Safety in the Plants

After the establishment of these economy devices the operators looked to increasing the safety of their men and equipment. This is the latest development in the industry. All buildings now are fireproof. Sheet steel on steel framework answers best for ease of erection and dismantling. All lines are buried where possible. Drains are kept free of inflammable liquids and water seals are provided for the protection of other users of the same drainage system. Cranes are installed where heavy equipment such as compressor heads is handled. Fire hazard has been lessened by cutting down the amount of gasoline stocked near the plant to a minimum, and by installations

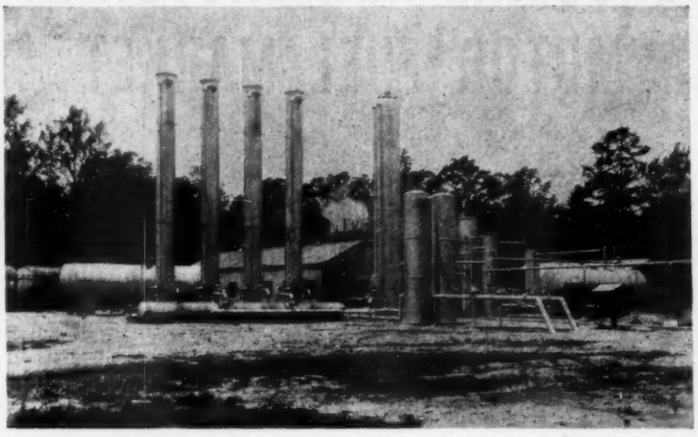
of proper firefighting apparatus. Education of the workers has been undertaken in many plants to increase both their safety and efficiency.

The Economic Background

Underlying every change that has occurred in the natural gasoline industry in the last 15 years was its economic aspect. The present-day market reveals a vast change over that of 1919. Intervening years saw still other conditions in consumption. At the beginning of the period, the main market for natural gasoline was with the Standard Oil Co. (Indiana). This company bought a blend of natural gasoline and kerosene, which after fractionating and blending at the refinery, was marketed as motor fuel. On this single demand, gasoline plants sprung up by the score. The ready profits of this business as long as the company bought the product blinded the operators to the possibility of a collapse of such a consumption. After a relatively short time the Standard Oil Co. (Indiana) began cutting the orders for the blend and then stopped the practice of buying the product. This threw the natural gasoline industry into a panic for new markets. By early 1921, the pressure of natural gasoline manufacturers brought down the excessive price that had been paid for the gas, and changed the basis of Indian royalties from the Chicago tank wagon prices of natural to the local tank car prices which were much lower. This period was mainly responsible for the bad name which was given natural gasoline. Manufacturers and jobbers attempting to market the product themselves, blended it with all manner of cuts including kerosene and even sold it straight after weathering it without control. The public quickly discredited this very inferior type of gasoline. There was no semblance of uniformity in the product. High compression equipment, also, which had been installed in the meantime in order to obtain higher yields from the gas, gave natural such a high volatility that it was rendered dangerous. Several accidents in transportation and storage added to the public's condemnation.

Revival of the Market

In early 1921 the Association of Natural Gasoline Manufacturers began work which was to revive the industry, and again place it on a paying basis. The first improvement was the adoption of standards for the product. The initial boiling point and the endpoint for raw and blended natural were designated. The blending and marketing again reverted to the refiners. Here at the refineries, scientific methods were developed for mixing the natural with straightrun and cracked gasoline. On July 1, 1926, the Natural Gasoline Association effected a working agreement with Dr. G. G. Brown and Dr. E. H. Leslie of the University of Michigan for a series of experiments and investigations that will always be remembered as having taken natural gasoline out of the "inferiority" classification as a motor fuel component. The work was later centralized in Doctor Brown's hands and the results he reported served as a basis for standardizing the quality of natural. He helped to direct manufacturers in recommending definite blends with refinery gasoline to make the best possible motor fuel and throughout the entire program of research, volatility was stressed until natural gasoline gained recognition as a premium product.



A modern gasoline plant in the year 1925. It was built for the Standard Carbon Co., and designed by H. E. Dickard-Monroe.

This research led to the establishment of a blend containing about 15 per cent natural. The name "casinghead" was dropped when referring to this type of gasoline. By these means the public was slowly brought to look with more favor upon natural gasoline blends. The movement toward better products and the resultant trend to fewer plants of larger capacity continued steadily. In 1921 there were a little over 1,000 plants in the United States averaging 1,167 gallons per day. In 1924 the number of plants increased by 10, and the average daily capacity per plant was 2,356 gallons. In 1923 a higher gravity gasoline was produced with no increase of the vapor pressure.

In 1926 the industry made the greatest advancement both in the quantity of production and the number of plants. By the end of the year it claimed 1,148 plants in which approximately $250,000,000 had been invested. That year the Phillips Petroleum Co. built what was then the largest plant in the world. It was located at Borger, Tex., and processed 40,000,000 feet of gas daily.

Vapor Recovery

But the industry was soon to suffer another setback. By 1928 the economy movement had spread to the refining industry. This together with the great increase in cracking units led to the general recovery of cracking still vapors. The practice widened and soon a sharp cut in refinery orders was felt. This developed through 1929 and 1930 to bring the natural gasoline industry to its second major marketing problem.

This time the remedy had to be found in retrenchment, further standardization of the natural, and in the development of new outlets. The production in 1930 was 2,210,494,000 gallons as against 2,233,688,000 in 1929. The amount of natural transported by pipe line also decreased in 1930. In 1933 the total capacity of natural gasoline plants decreased for the first time in history.

In December of 1930 the Association of Natural Gasoline Manufacturers drew up a system of grading for natural gasoline. This new method gave natural gasoline an official set of specifications and classed the products into 24 groups, depending on the Reid vapor pressure and the percentage evaporated at 140° F. The system was offered for optional adoption during 1931 and was declared fully effective on January 1, 1932. By the end of

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Terminals at

BAYONNE, N. J.
ELIZABETHPORT, N. J.
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GREEN ISLAND, N. Y.
ROCHESTER, N. Y.
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TONAWANDA, N. Y.

MARKETERS OF
FINE PETROLEUM PRODUCTS

1931 it was found that 65 per cent of the product leaving the plants could be classified under the 26-70 heading. So this grade was adopted as standard and all natural gasolines were priced in comparison with it. Thus the new method of grading natural gasoline turned out to be very simple regardless of the 24 grades allowed. The old system of A, AA, B, BB and C grades was abandoned completely on January 1, 1932.

The first export cargos of unblended natural gasoline left the Gulf Coast in 1923. The European buyer was so skeptical of the ability of the shipper to make delivery, that the order was entered only on agreement that the material should be placed in the buyer's tanks on the Continent. The shipment was completed after great difficulty in finding a tanker that would carry the product.

In December, 1932, the basis of buying wet gas from the producers was finally settled by means of the standard form casinghead contract. This had been used by several major companies and its recognition by the association established it throughout the industry. The contract contained a schedule of prices to be paid for wet gas in conformity with the price received for the finished natural gasoline.

The first radial cone tank built in 1933 for the Warren Petroleum Co. at its Houston, Tex., terminal

Liquefied Gases

Although the bulk of the products of natural gasoline plants at present goes into the blending of motor fuels, an important market has developed for what are termed liquefied gases. The liquefied gas market has been existent for many years, but its development into a major market took place only recently. The Phillips Petroleum Co. first took advantage of this potential market by putting out a liquefied gas in cylinders for domestic use.

For the manufacture of liquefied gases, highly efficient rectifying equipment is necessary. With rectifiers equipped for pressure operation and aided by intercoolers, a very satisfactory separation of the light hydrocarbons can be effected. As soon as these fractions are isolated they are stored in pressure tanks, usually of spheroid design, and shipped either in cylinders or special pressure tank cars.

The demand for this type of product is mostly for use as a domestic fuel for cooking. However, there is a widely diversified market for butane and propane in the chemical field. They can be used straight as solvents for rubber, soaps, perfumes or paints. By chlorination of butane other solvents are obtainable. Butane, furthermore, promises to be a very important source in the manufacture of butanol which is used in the making of paint, explosives, lacquers and photographic supplies.

Butane has been used for a number of years in the cutting of metals, as a heat-treating fuel and as a household fuel. Polymerization of these lighter gases is also being studied and at least one commercial size installation is processing them to make a motor fuel of high anti-knock value.

In the immediate past natural gasoline has passed through a prolonged period of low prices in which some companies were forced to abandon certain low-capacity plants. In 1933 the number of operating units was greatly reduced and comparatively few new plants were built.

East Texas

In 1933 eight plants were built in the East Texas Field but none of them was large in comparison with plants in other flush fields. The East Texas gas was rich enough in gasoline content but comparatively little was produced with the crude. By the close of the year there was greater need for plants because of the increasing number of wells and some built units in expectation of supplying gas for the flowing of wells. Although the production from these plants increased monthly, the total output still remains relatively low. The gas fractionating type of plant has gained favor in that field and that type of unit represents one of the most important steps in the progress of plant design and construction in the past year.

Panhandle

The singling out of the Panhandle area of Texas as a field in which gas could be produced and processed without utilization of the residue came as a surprise to many but this step was taken in 1933 by the Texas Legislature. As a result, many of the older plants extended their gathering lines and several very large stripping plants were built to take advantage of this law. Three such units were built, each processing more than 100,000,000 feet of gas daily and making in excess of 40,000 gallons of gasoline daily. These stripping units are unique in that they operate on well pressure and utilize the residue gas for pumping and the transfer of all liquids in the plant. The plants may be constructed at a low investment and may be operated at an expense of less than 1 cent per gallon, so it is easy to see how they have become an important factor in the market as well as representing an innovation in design and operation.

NATURAL GAS POWERED RIGS

Throughout many Gulf Coast fields, drilling and pumping rigs are using Natural Gas fired boilers. The abundant supply of this fuel, its efficiency and economy, together with the availability of this company's service in several producing areas, are making Natural Gas more and more popular with the oil industry.

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Sp-6-A

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Since 1891

TAXES, MARGINS AND SERVICE STATION GROWTH ADDED TO MARKETING PROBLEMS

MARKETING—ERA NUMBER 5 1919-1934

The haste with which it became necessary to supply the rapidly increasing demand for gasoline, long a waste product, as the automobile advanced from the luxury class to that of necessity, gave rise to conditions in marketing which are today baffling every attempt at stabilization. The code of ethics, urged by the American Petroleum Institute and code of fair marketing practices provided by the "new deal," represent the most pretentious plans to correct those early mistakes.

At the beginning of the period 1919-1934, only two of the larger companies were active in the construction of their own gasoline filling stations. These were the Pure Oil Co. and the Texas Co. The other companies had resorted to what appeared to be the more economical plan of dealing with garages, privately owned establishments which compared unfavorably with the company-owned stations, and loaning or leasing pumps to individuals. After 1922, however, there was a strong movement toward the company-owned plant which could compare only with that of 1931 when the various companies began moving into territories beyond their old boundaries.

The Dole race from Oakland, Calif., to Hawaii on August 16, 1927, stimulated interest in the use of natural gasoline as an aviation fuel. It had been furnished by the Phillips Petroleum Company as a 100% superstabilized natural gasoline.

Number of Filling Stations

The following table, taken from "The Oil Industry's Answer," in the March 20, 1924, issue of The Oil and Gas Journal, shows that the largest 12 oil companies sold gasoline through 4,089 of their own stations, and through 79,207 outside interests to which they had loaned, leased or sold pumps:

Company—	Service stations	Pumps leased, loaned or sold
Atlantic Ref. Co.	91	17,513
Gulf Ref. Co.	187	9,707
Texas Co.	161	6,188
Standard Oil of N. Y.	10	19,000
Union Oil Co. of Calif.	237	.....
Shell Co. of Calif.	204	.....
Sinclair Ref. Co.	121	2,152
Standard Oil of N. J.	87	15,000
Standard Oil of Ohio	410	2,500
Standard Oil of Indiana	1,668	4,799
Standard Oil of Calif.	700	.....
Pure Oil Co.	213	2,348

It was estimated on the basis of proposed construction, that between $25,000,000 and $50,000,000 would be spent by these companies in the next two or three years in building their own retail outlets.

In 1929, according to the census figures, there were 123,979 filling stations doing a business in that year of $1,883,842,465. In 1931, one company alone, the Phillips Petroleum Co., entered the densely populated Chicago district and had within two years nearly 600 retail outlets in that area, and at least four huge bulk plant terminals. The other companies, while not so spectacularly, likewise extended their marketing fields. New stations continued to go up on corner lots while executives of oil companies complained that marketing facilities were expanded 75 per cent beyond economic limits.

Margins Established

After 1921, when crude oil could be obtained more freely, small refineries began to dot the producing areas, and the operators of these plants sold at cut prices in tank car lots to the type of dealer who became the trackage station seller. The established oil companies continued to sell to jobbers and private drive-in station owners, who used the company's or their own brand name. Margins at the beginning were 1 cent under the posted service station price, but the race for new outlets, as early as 1924, brought out 3 and even 4-cent spreads. The larger marketing companies are still hoping to adjust margins to a point which will not give rise to constant price cutting.

The trend in net service station prices was as follows: 1919, 25.41 cents; 1920, 29.74 cents; 1921, 26.11 cents; 1922, 24.82 cents; 1923, 21.06 cents; 1924, 19.1 cents; 1925, 19.92 cents; 1926, 20.92 cents; 1927, 18.01 cents; 1928, 17.63 cents; 1929, 17.91 cents; 1930, 16.33 cents; 1931, 13.09 cents; 1932, 13.3 cents; 1933, 12.76 cents; 1934, 13.9 cents (first six months).

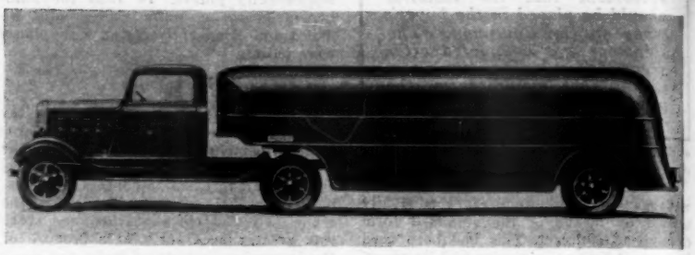
Gasoline Tax

The sales tax on gasoline rose steadily from 1 cent levied in Oregon in 1919 for road construction and maintenance purposes, to 8 cents in three states in 1934, and averaged, for the country, a sales levy of 43.59 per cent, retail, and more than 100 per cent, wholesale. Senator Capper, in an appeal in 1934 to the Congress to drop the 1-cent Federal tax, said that automobile owners are taxed annually around 25 per cent of the total value of their property. In 1933, the senator said, the motorist paid the following taxes:

State gasoline taxes	$519,000,000
State license fees	300,000,000
Federal gasoline tax	181,000,000
Federal lubricants tax	22,000,000
Federal tax on cars and motorcycles	22,000,000
Federal tax on tires	28,000,000
Federal tax on parts	4,000,000
Federal tax on trucks	3,000,000
Personal property taxes in some states	.....

It may be pointed out that the Federal aid highway expenditures, sometimes used to justify the Federal taxes mentioned above, have been more than paid for by motorists since 1917, according to Senator Capper. The original Federal aid highway act was passed in 1916, and for years from 1917 to March 1, 1934, collections from motor vehicles, as reported by the U. S. Bureau of Internal Revenue, have amounted to $1,502,584,784.96, while expenditures for road building have totaled $1,472,250,824.15. The story of tax evasion is too well known for presentation here. It may suffice to say that only in recent years has an effective campaign been waged against this evil.

In the preceding periods the petroleum industry made great progress in extending the usefulness and demand of petroleum products. In the present period these advances were continued and improvements were effected along merchandising lines.



Streamline type of trailer for carrying gasoline

Utilization of Petroleum

Shortly after the opening of the fifth period in the marketing history of the petroleum industry, 1919-1934, there was presented an outline which may be accepted as an inventory of oil utilization. Crude oil was converted thus (in order of gravity):

Liquefied gases for metal cutting and illumination; petroleum ether for laboratory uses and priming engines; carbon black for rubber tires, inks and paints; fuel gas; light naphthas for gas machines and solvent uses. Alcohols and their many derivatives and the solutions such as lacquers, soaps, phenol, varnishes, derived from refinery gases.

White distillates, from which are produced aviation gasoline, motor gasoline, commercial solvents, blending naphtha, varnish and paint naphthas, cleaning fluid, illuminating and heating oils, absorbent oils. Gas oil and mineral seal oil for carburetion of water gas, for metallurgical uses, cracking stock, Diesel fuel, and natural gasoline or benzol recovery.

The heavy distillates were divided thus: Technical heavy oil producing white oils, saturating oils, emulsifying oils, electrical oils and flotation oils; wax, and light lubricating oils. From these are produced technical and medicinal oils, wool and twine oils, candles, saturating wax, detergent wax and chewing gum wax; light spindle oils, compressor oils, ice machine oils, journal oils, motor oils, steam cylinder oils, water soluble oils, valve, turbine and transmission oils, railroad oils and grease compounding oils.

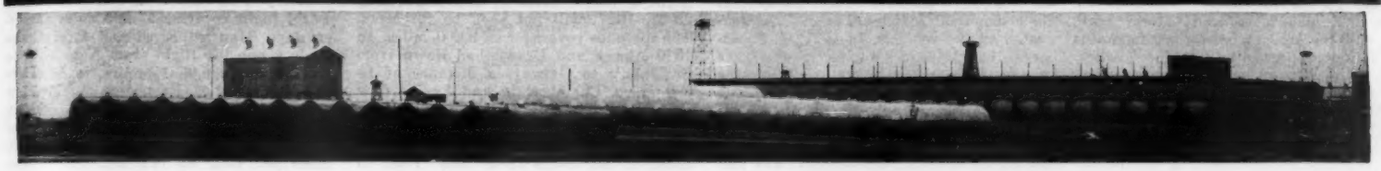
From residual oils are produced greases, fuel oil, tars, road oils and coke. From these petrolatum, gear, switch and cup grease, boiler fuel, oil-gas, asphalts, and carbon materials are manufactured. The refinery sludges provide acid coke for fuel; sulphonic acid for saponification and demulsifying agents; oils and tars; sulphuric acid.

Sealed Containers

In 1933 the movement to merchandise lubricating oils in "refinery sealed quart and five-quart cans" spread throughout the industry. Kendall Refining Co., Canfield Oil Co., the Pennzoil Co., Quaker State Refining Co., Pennsylvania Refining Co., Valvoline Oil Co. and Tide Water pioneered. Before this the bonded can had been introduced by Oil Creek Refining Co., which was the first to produce a zero pour test Pennsylvania lubricating oil. The Pennsylvania refiners had, in 1929, faced the loss of practically all of their outlets for lubricants by the intro-

A modern filling station

GRAVER



A Diamond Jubilee in Steel Plate Fabrication

For 75 Years Graver Has Been Growing With the Petroleum Industry

During all these years the GRAVER Organization with facilities of economical manufacturing, fabrication and field erection, unexcelled, has been building integrity into its products. From your specifications or designed to your requirements, GRAVER fabricates and erects field storage with or without floating roofs and refinery equipment including agitators, condenser boxes, run-down tanks, stills, pressure vessels, bubble towers, treating tanks and high or low pressure gas holders with necessary fittings. Also, GRAVER builds bulk plants and service stations, complete, truck tanks and distributing accessories.

To you men in every branch of the Industry, the GRAVER Organization offers its aid in solution of present difficulties and in the moulding of a great future that will far outshine the past. · Let GRAVER figure with you on economical, modern erection.

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STORAGE

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

duction of the "lease and agency" marketing plan in which retail outlets were restricted from the sale of products other than those manufactured by the company furnishing the gasoline. The 2-gallon can was the Pennsylvania industry's answer. In a short time nearly all of the larger oil companies were selling crankcase lubs at cut prices in five-gallon containers and were also providing the chain stores and department stores with "loss leader" oils. In 1931, price cutting developed into a real threat to the established oil companies, although it was not until 1933 that these companies followed the "third grade gasoline" with a 15-cent motor oil.

It was in 1923, on February 1, that the Refiners Oil Co. placed on sale in Dayton, Ohio, a new gasoline which was to become known as "Ethyl." Charles F. Kettering, who introduced battery ignition and the self-starter for automobiles, had found that gasoline "knocked" when used in engines where the compression was increased to raise efficiency. Thomas E. Midgley, Jr., and T. A. Boyd soon found that the worst knocking gasolines could be made suitable for high compression engines by the addition of iodine. These investigators tested more than 33,000 chemical compounds and eventually produced "Ethyl brand of antiknock compound." In 1926 the now familiar "octane scale" was proposed. The Ethyl Gasoline sold at a premium of 3 cents above the competitive grade. It is interesting to note that the development of this gasoline resulted in producing a method of extracting bromine from sea water on a commercial scale, a plant in 1934 at Kure Beach, Cape Fear, N. C., extracting 15,000 pounds daily from about 30,000,000 gallons of ocean water. In the summer of 1933 the use of tetraethyl lead was greatly expanded by its addition to the regular grade of gasoline.

Higher Viscosity Index

In 1934 the "race for octane ratings" gave way to a new development, "the race for higher viscosity index." This was in the motor oil field, and the processes introduced to approximate in western lubricants the qualities of Pennsylvania oils, which sold at a premium, are discussed at length in the refining history of the petroleum industry. It may be said that no other product of the industry is so widely and intensively advertised as motor oils.

Before proceeding to the statistical tables which tell the story of this period in the clearest language possible, some of the high points in the history of oil marketing and utilization may be presented as follows:

In 1922 M. K. Lee Guinness drove his Sunbeam Special 96.63 miles per hour to break all automobile speed records. In 1923 the French government sought to encourage the use of producer gas as fuel for commercial vehicles. The gas was generated on the vehicles. In 1921, C. Eickemeyer had introduced the compound gas engine. In 1919 the motorists of the United States were consuming an average of 454 gallons of gasoline per year and by 1928 the average consumption per car had risen to 604 gallons a year. In 1926, the service stations numbered 12,644 and there were 15,128 bulk plants. Motorcycles had come into popularity in 1921, and in 1926 the number of these vehicles manufactured by countries was as follows: England, 120,000; Germany, 60,000; United States, 45,000, and France, 25,000. In this same year light, high-speed Diesel engines were installed in trucks in Germany. In the following year, 1927, the street car type bus appeared in the United States. In 1929 the Packard Motor Co. developed a Diesel engine weighing 3 pounds per horsepower, and when installed in an airplane this engine was able to use 26 degrees A.P.I. gravity fuel oil.

Notable Achievements

In 1933, Sir Malcolm Campbell drove his special automobile on Daytona Beach at a speed of 272.11 miles per hour. In the field of aviation, the transatlantic flight of Col. Charles A. Lindbergh, May 20-21, 1927, will not soon be forgotten. The distance covered was 3,600 miles. In 1919 Alcock and Brown had flown from St. John's to Galway, a distance of 1,900 miles. Chamberlain and Levine flew from New York to Eisieben, Germany, 3,911 miles, in June of 1927, and in July 28-30, Boardman and Polando made a flight in 49 hours from New York to Istanbul, a distance of 5,011 miles. In 1928, October 29-November 1, Dr. Hugo Eckener, Germany, in the Graf Zeppelin equipped with five Maybach 450-550 horsepower engines, flew from Lakehurst, N. J., to Friedrichshafen, Germany, 3,967 miles. Juan de la Cierva, in 1933, exhibited his autogyro which will change direction upward, downward, or sideways by merely tilting the rotor shaft, discarding ailerons, elevator and rudders.

In the same year Auguste Lemoine reached an altitude of 48,805 feet, and Lieut. Comdr. Thomas G. W. Settle and Maj. Chester L. Fordney made a balloon flight into the stratosphere reaching an altitude of 61,237 feet, or more than 11⅝ miles. The first of the superspeed records was set by James R. Wedell at 304.98 miles per hour in a land plane. Other outstanding events in aviation in 1933 include the following:

Wiley Post made a solo round the world flight covering 15,596 miles in seven days. Maurice Rossi and Paul Codos made a nonstop flight from New York to Rayak, Syria, 5,653½ miles, in 56 hours and 12 minutes. Francesco Agello flew over a 3 kilometer course three times in each direction at an average speed of 423.7 miles per hour and reached 430 miles per hour on one lap. The hydroplane used was a Macchi 72, weighing 6,050 pounds, engined to develop 2,500 horsepower, and a minimum speed of 130

OKLAHOMA
(Cents per gallon)

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
U. S. Motor	.0978	.0896	.1055	.1031	.0667	.0795	.0775	.0634	.0345	.0392	.0311	.0379
Natural (75-85)	.0913	.0866	.1202	.0946	.0675	.0724	.0682	.0524	.02	.0222	.029	.0234
Kerosene, w.w. (41-43)	.04	.0449	.0445	.0737	.0461	.0517	.0517	.0358	.0231	.0215	.0279	.0290
Fuel oil (24-26), bbl.	.9511	.954	1.091	1.3072	.9792	.7694	.706	.7043	.4356	.4548	.5048	.7067
U.G.I. gas oil	.0266	.0291	.0368	.0419	.0299	.0247	.0265	.0227	.0127	.0146	.0146	.0214
200 neutral, h.c.t.	.1317	.1308	.1139	.1072	.1032	.0947	.0966	.1059	.0924	.0834	.0845	.0913
124-126 wax, lb.	.0254	.0446	.0516	.0471	.0294	.0394	.0321	.0216	.0174	.017	.0253	.0385
Bright stock, 150-160 D	.....	.....	.....	.....	.....	.231	.3263	.2977	.1631	.1827	.1852	.2370
Crude, 36 degrees A.P.I.	1.36	1.62	1.87	2.13	1.38	1.31	1.37	1.23	.63	.88	.62	1.00

PENNSYLVANIA

U. S. Motor	.1352	.1224	.1348	.1273	.09	.0982	.0905	.0727	.049	.0563	'0505	.0519
Kerosene, w.w. (45)	.0652	.0671	.0656	.0885	.0646	.0635	.0651	.0501	.04	.0451	.0446	.0451
Bright stock, 10-15	.3237	.3655	.3324	.3954	.3226	.3186	.4745	.3372	.2094	.2466	.2407	.29
Crude, N.T. lines	3.33	3.60	3.50	3.51	2.87	2.98	3.69	2.55	1.81	1.88	1.86	2.49

CALIFORNIA

U. S. Motor	.....	.....	.....	.1134	.0873	.0919	.0849	.0806	.0510	.0546	.0523	.0555
Natural (75-85)	.....	.....	.....	.1465	.093	.0726	.0803	.0712	.0418	.0447	.0462	.0515
Kerosene (38-40)	.....	.....	.....	.0745	.07	.0611	.0569	.0455	.0425	.0398	.0384	.0461
Fuel oil (18-20), t.w.	.....	.....	.....	.9813	.9221	.8892	.6734	.6346	.5836	.5548	.5162	.6000
Crude, 25 degrees, Signal Hill	0.74	1.06	1.35	1.37	1.00	.96	1.05	1.16	.76	.83	.84	.94

Natural Gas—The Servant of Mankind

INSCRIPTION ON TABLET READS:

ORIGINAL SPEECHLEY SAND GAS WELL
Drilled by Samuel Speechley
COMPLETED APRIL 15, 1885—Depth 1963 FT.

At this discovery well the Speechley Sand, one of the best known and most prolific gas producing horizons in eastern United States, received its name. When completed the natural gas from this well was sufficient to supply all the consumers in Oil City, Pennsylvania. The well is still of commercial value even though the volume and rock pressure of the gas have greatly declined. The well is operated by
UNITED NATURAL GAS COMPANY
Erected July, 1930.

Like so many important discoveries contributing to man's well-being, Natural Gas often is taken for granted and used without appreciation of what it means in point of comfort, economy, convenience, cleanliness and health.

Still, in the modern ALL-GAS HOME, Natural Gas reduces housework to the minimum and raises efficiency to the maximum. A glance into the kitchen, the laundry and the basement reveals the reason: Cooking, refrigeration, hot water supply, house heating, laundry work and incineration are all performed by automatic Natural Gas "servants."

Natural Gas does these necessary services more satisfactorily than any other fuel. Unquestionably, it is the most efficient, most economical and most dependable of modern fuels. It is self-operating, clean and above all, simple, easy and convenient to use.

Truly a servant, Natural Gas, by eliminating so many irksome household duties, contributes the maximum toward physical well-being and the joy of living.

UNITED NATURAL GAS COMPANY
OIL CITY—PENNSYLVANIA

miles per hour. Col. Roscoe Turner flew from New York to Los Angeles in 11 hours and 30 minutes, and from Los Angeles to New York in 10 hours and 5½ minutes for an average speed of 271 miles per hour.

On October 21, 1929, the German DO-X airplane, with a wing spread of 157 feet and length of 130 feet, was introduced. This giant could carry 75 to 100 passengers at a cruising speed of 110 miles per hour and a maximum speed of 135 miles per hour. Among other events of interest in aviation may be listed the establishment of the first regular night flying service between Chicago and Cheyenne, in 1924; the passage of the Kelly bill in 1925, authorizing the postmaster general to make contracts for air mail.

Railroad Diesel

In the November 16, 1933, issue of The Oil and Gas Journal was described a development which may prove as significant to the industry as was the growth of the automobile. This was the introduction of the high-speed Diesel electric trains by the Chicago, Burlington & Quincy Railroad, and the Union Pacific and Texas Pacific Railroads. Other innovations of this type include the "Railplane," of Stout Engineering Laboratories, the Clark 16-cylinder "Autotram," and the gasoline FWD high-speed railway bus. It is pointed out that Diesel trains were tried in 1910, but were abandoned because of vibration. The new trains are driven by electric motors connected with the Diesels, and present a fully streamlined exterior and comfortably appointed interior to offer a 90 to 100-mile an hour service in competition with the fast growing air transportation business. Aluminum is used to a large extent in the construction of the Diesel engines as well as bodies of train units. A Diesel weighing less than 25 pounds per horsepower can be produced with this metal without sacrifice of established design factors.

In the world markets there were numerous changes since the closing of the war. By mergers and realignments in distribution systems abroad the oil companies of the United States consolidated their positions. The importation of gasoline, naphtha and crude oil from Rumania, Russia and South America (Aruba), was lowered in 1933 by the imposition of taxes. Abroad, the oil business in this final period came under close supervision of nearly all of the governmental authorities. In 1921 the Rumanian petroleum industry was nationalized. In 1927, government control and subsidization became the rule. Spain turned the business over to a banking consortium; the French state monopoly was proposed, and Italy established the state subsidized "Azienad Generale Italiana Petroli" to keep prices down by underselling tactics. In Russia the industry was completely nationalized, and in Poland the petroleum cartel was established to control production and sales. Greece had long had a monopoly in kerosene in effect, while Australia had subsidized refining and marketing at considerable expense to the taxpayers. The Mexican oil industry, and that of the oil producing South American countries, is under rigid government control.

PEANUTS BROUGHT $15 EACH

While yellow fever was ravaging the lower Mississippi Valley, taking more than 5,000 lives in New Orleans, La., and Memphis, Tenn., alone, an Italian peanut vender on September 12, 1878, gave a pint sack of the nuts to a member of the Parker Oil Exchange with the request that they be auctioned off for the benefit of the plague sufferers. James F. Hughes served as auctioneer and $232.80 was realized. Two of the peanuts were bid up to $15 each.

At the beginning of 1934 there were 1,680 tank steamers in use, 625 of which were in international trade and ranged in capacity from 75,000 bbls. to more than 100,000 bbls. Shifting in source of supply in 1930 and 1931 for the United Kingdom, France and Germany affected the United States as follows: In 1931 the United States oil companies lost 4,026,914 bbls. English trade, while Rumania gained 1,634,364 bbls.; Russia gained 166,265 bbls., and Persia lost 967,860 bbls. In France the United States lost 1,444,820 bbls.; Persia gained 1,226,045 bbls.; Russia, 1,326,062 bbls.; Rumania, 1,480,426 bbls. In Germany, the United States lost 1,404,461 bbls.; Russia gained 537,701 bbls.; Rumania lost 400,461 bbls., and Persia, 52,439 bbls. In the following tables are presented the trends in refined products for the United States since 1918:

GASOLINE
(1,000 bbls.)

Year—	Prod.	Imports	Exports	Dom. demand
1918 ...	85,007	307	13,544	74,506
1919 ...	94,235	203	9,097	81,783
1920 ...	116,251	964	15,636	101,208
1921 ...	122,704	900	13,134	107,525
1922 ...	147,672	1,479	14,156	127,906
1923 ...	179,903	4,555	20,741	156,746
1924 ...	213,326	3,453	28,967	185,003
1925 ...	259,601	3,813	31,497	223,865
1926 ...	299,734	5,540	43,313	261,813
1927 ...	330,435	5,002	44,337	296,807
1928 ...	376,945	4,198	52,904	328,489
1929 ...	435,078	8,834	61,265	372,468
1930 ...	432,241	16,927	63,195	388,689
1931 ...	437,735	13,621	45,716	403,418
1932 ...	399,524	8,209	35,434	373,720

KEROSENE
(1,000 bbls.)

Year—	Prod.	Imports	Exports	Dom. demand
1918 ...	43,461	.....	11,820	34,442
1919 ...	55,753	.....	23,536	33,188
1920 ...	55,240	.....	20,878	33,082
1921 ...	46,312	.....	18,016	29,537
1922 ...	54,913	3	21,489	34,854
1923 ...	55,927	7	20,347	35,048
1924 ...	60,026	10	21,961	36,712
1925 ...	59,689	19	21,212	39,969
1926 ...	61,768	74	22,248	38,140
1927 ...	56,113	55	19,537	37,491
1928 ...	59,353	262	22,034	36,235
1929 ...	55,940	208	20,022	36,032
1930 ...	49,208	200	16,884	34,736
1931 ...	42,446	11	12,712	31,296
1932 ...	43,836	72	10,956	33,310

GAS OIL AND FUEL OIL
(1,000 bbls.)

Year—	Prod.	Imports	Exports	Dom. demand
1918 ...	174,319	.....	29,636	142,751
1919 ...	181,602	.....	16,487	163,803
1920 ...	210,987	.....	22,080	185,972
1921 ...	230,091	.....	22,676	196,656
1922 ...	254,910	2,947	18,479	240,010
1923 ...	287,481	12,286	33,372	261,388
1924 ...	320,476	12,927	37,249	292,452
1925 ...	364,991	12,245	36,088	.....
1926 ...	365,195	14,432	38,351	.....
1927 ...	393,006	8,124	47,391	.....
1928 ...	427,237	7,268	44,427	.....
1929 ...	428,219	20,545	39,151	.....
1930 ...	372,498	26,080	36,450	.....
1931 ...	336,967	24,998	29,231	.....
1932 ...	294,287	21,229	19,874	.....

LUBRICANTS
(1,000 bbls.)

Year—	Prod.	Imports	Exports	Dom. demand
1918 ...	20,035	.....	6,165	13,822
1919 ...	20,161	.....	6,598	13,600
1920 ...	24,938	.....	9,643	14,742
1921 ...	20,896	.....	6,936	12,047
1922 ...	23,304	43	7,941	15,528
1923 ...	26,128	29	8,372	17,260
1924 ...	27,498	11	9,103	18,124
1925 ...	31,055	37	9,678	20,581
1926 ...	32,293	33	9,435	22,568
1927 ...	31,721	8	9,776	21,669
1928 ...	34,658	13	11,023	23,168
1929 ...	34,359	39	10,860	23,609
1930 ...	34,201	25	9,935	31,589
1931 ...	26,704	32	8,128	20,068
1932 ...	22,433	11	6,857	16,697

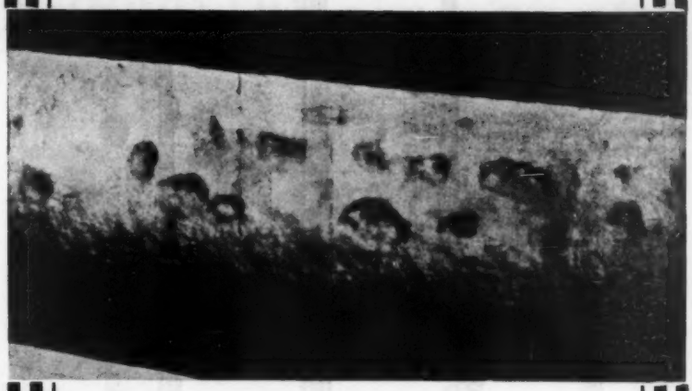
WAX
(1,000 pounds)

Year—	Prod.	Imports	Exports	Dom. demand
1918 ...	505,144	5,647	236,543	210,650
1919 ...	467,235	9,383	263,345	190,969
1920 ...	541,204	7,629	375,276	200,651
1921 ...	434,884	4,546	225,881	201,354
1922 ...	462,003	7,447	284,501	187,821
1923 ...	466,647	12,643	329,793	189,830
1924 ...	516,491	12,867	382,820	221,590
1925 ...	590,577	14,588	334,179	344,301
1926 ...	645,815	9,983	335,584	251,274
1927 ...	584,347	20,462	340,423	282,503
1928 ...	630,144	24,741	392,705	302,474
1929 ...	630,074	40,860	319,324	274,572
1930 ...	547,680	30,402	292,973	242,109
1931 ...	477,400	37,835	290,527	276,457
1932* ..	1,639	119	840	946

*In thousands of barrels (1932).

Price trends in the principal products from the Oklahoma, Pennsylvania and California districts are shown in the accompanying table compiled from the weekly price quotations of The Oil and Gas Journal and the Oil City Derrick. The prices do not include Federal excise, processing or production taxes, nor similar taxes levied by certain states.

STOP



THIS

For 15 Years NO-OX-ID Has Been Preserving the Steel of the Oil Industry

The story of NO-OX-ID in the Oil Industry is written in its proud service record of preserving millions of dollars worth of investments in steel from rust. During the past fifteen years, hundreds of miles of pipe line have been coated and protected with NO-OX-ID. Still in service is underground pipe which, badly pitted at the time, was cleaned with hand scrapers and coated with NO-OX-ID in the early years when NO-OX-ID was going through its "test period." The pipe has shown no further deterioration and there is no record of leakage due to the old pits.

As severe soil conditions were encountered, NO-OX-ID was adjusted to meet them. NO-OX-ID-IZED Wrapper was developed, and then the famous Master Coat. In one case a 9-inch concrete highway has been laid over a pipe line protected with the Master Coat.

NO-OX-ID is low in cost because of the greatly extended period of protection it gives. This protection is reliable because it acts chemically under the film and mechanically in the film.

In addition to pipe lines, NO-OX-ID is used extensively on condenser coils, inside tops of agitators, tanks, steel derricks, meters, cables and wire lines, and on stored pipe, couplings, and steel parts.

NO-OX-ID is a product of the Oil Industry since its base, which carries the necessary inhibitors to corrosion, is a product of petroleum.

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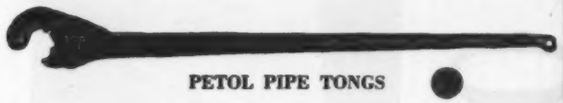
TRADE MARK
The Original Rust Preventive

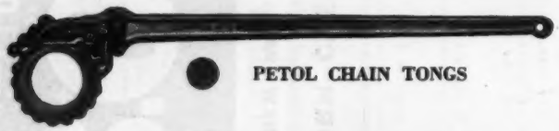
MOST COMPLETE LINE OF TONGS IN THE WORLD

PETOL CARRYING BARS

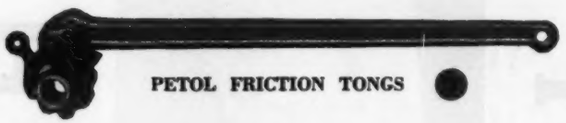
PETOL TUBING TONGS



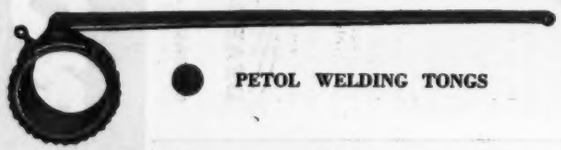
PETOL PIPE TONGS



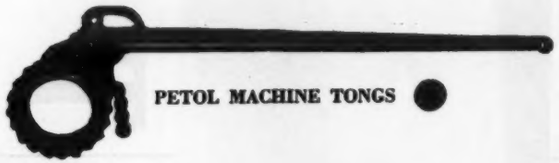
PETOL CHAIN TONGS



PETOL FRICTION TONGS



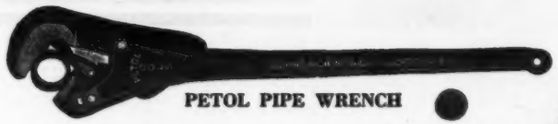
PETOL WELDING TONGS



PETOL MACHINE TONGS

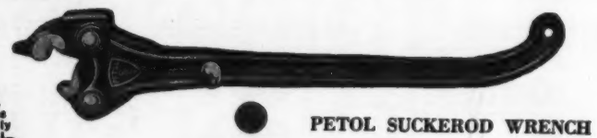
GEARENCH MFG. COMPANY
HOUSTON, TEXAS

PETOL BACK-UP TONGS



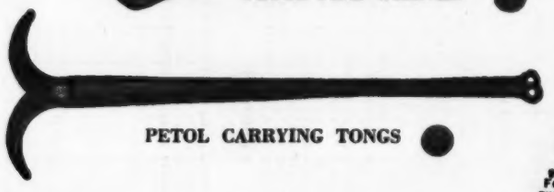
PETOL PIPE WRENCH

The World's Favorite Tongs—Safest, Fastest, Strongest made. Well balanced, light, sure-grip. Stabs on jaws automatically engaging. Cam lock permits turning tubing in either direction, and eliminates tongs coming off.



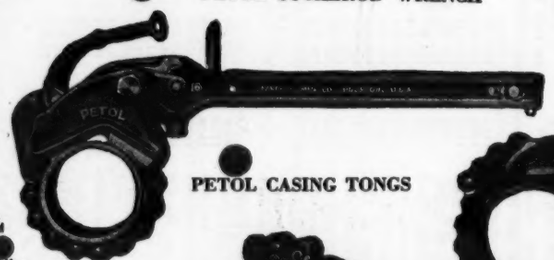
PETOL SUCKEROD WRENCH

Fastest, Lightest, and Safest pipe tongs. Instant grip and perfect ratcheting. No crushing. Single handle eliminates mashed fingers. Four edge bits, easily turned or replaced, of high speed steel.



PETOL CARRYING TONGS

New principle embodied in chain tongs; insures more strength, less weight, less crushing and no jamming. Tongs rest on work; easier on the operator. Ratchet perfectly, and release instantly. All sizes, No. 11 to No. 16.



PETOL CASING TONGS

The "Little Mahoney" on any pipe line job. Light, durable, safe. Fit several sizes of pipe. Will ratchet or turn pipe in either direction, without removing. Made in two sizes for 4-inch or smaller pipe.

PETOL BACK-UP POST

No teeth or bits. Turns job by friction alone. Curved, one-piece jaw protects pipe against damage. Cannot jam or bind. Made in sizes 1" to 8" and special sizes.

Chain friction type with no teeth. 72" handle gives extra leverage. Reversible without removing from pipe. Gripe and releases instantly. Light but strong. Weight carried on pipe when applied.

For hard service on drilling rigs. Handle and jaws made integral to increase strength. Shapes of steel teeth inserts to suit the job. I-beam handles treated for strength.

For back-up work on pipe machine or pipe line jobs. Lightest, most convenient tongs made. Positive grip, non-crushing. Perfect ratcheting. One-piece jaw, replaceable inserts. Sizes for pipe 1¼" to 22".

PETOL BULL TONGS

PETOL STABBING TONGS

Strongest chain-type tongs made. Positive, non-crushing grip. Cannot jam. Perfect ratcheting. Patented balancing hanger. Replaceable steel inserts. Especially convenient on casing or "nippling up" jobs.

PETOL Casing Tongs and Post offer safest method for "running-in" casing and drill pipe with make-and-break rotary. Tongs move down as pipe makes up. One tongs, size 16, will handle sizes 4¼" to 13⅜".

Simple in design but strong, rugged, durable, and exceptionally light. Fold together when not in use. High quality to guarantee minimum wear, and positive safety. All popular sizes.

Like the Carrying Tongs, PETOL Carrying Bars are light, strong, and durable. Made to fit the pipe and eliminate danger of pipe jumping. A quality tool for your next job.

Entirely new wrench for pipe work. Self-adjusting to work. Ratchets freely, no jam. Strongest pipe wrench made. High Speed Steel inserts in larger sizes. Sizes 8" to 60".

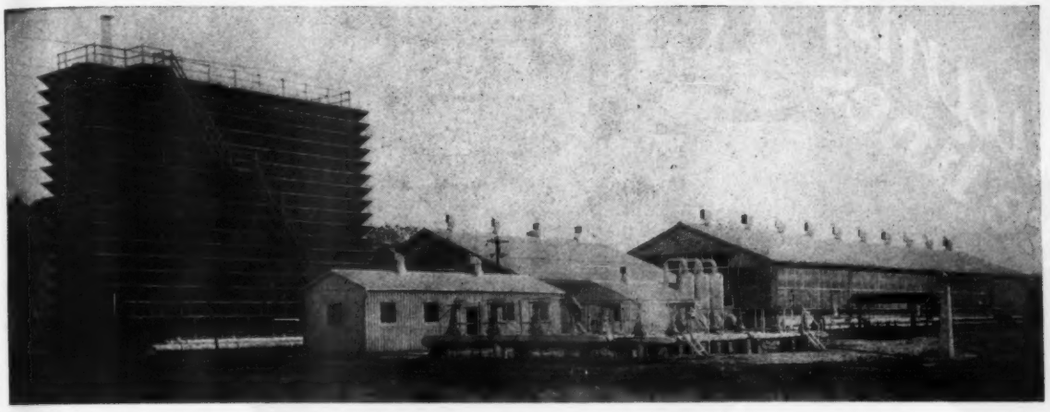
Ratchets freely—Has "Hammer Action" for handling tough joints. On and off easily. Will not fall off. Fast, Safe, Strong. Sizes 1, 2 and 3 in. lengths from 12" to 36".

PETOL Back-Up Post offers greater safety and convenience to crew. Designed for maximum strength. Projections on Post prevent Tongs falling down before strain is put on them. Sizes for all rotaries.

PETOL Back-Up Tongs offer the drilling crew safety and speed on all back-up jobs. Designed for great strength with minimum weight. Replaceable high-speed steel teeth inserts.

PETOL
BACK-UP TONGS

CONSERVATION AND THE ELIMINATION OF WASTE GOAL OF NATURAL GAS INDUSTRY



Main line natural gas pumping station

NATURAL GAS—ERA NUMBER 5 1919-1934

The fifth and present period in the history of the natural gas industry opened on the note of conservation and elimination of waste, a goal that was not approached until the past few years because of uncontrolled output in newly discovered oil pools of extremely high potential. The means for minimizing natural gas waste attending production of oil had been developed in the preceding period, but it was not until 1920 that conservation took on a general aspect. Methods had been devised before 1914 to prevent blowouts. In 1913 it was pointed out that a large amount of gas waste was due to the escape of casinghead gas from oil wells. In Kansas gas production from this source was estimated to average 300,000 feet per well per day, and in four Oklahoma fields the waste of casinghead gas was estimated at 70,000,000 feet daily. In 1913 mud laden fluid was introduced to eliminate waste of natural gas while drilling for oil. Oil and gas separators had been introduced in 1912. Siphons, bailing machines and swabbing lines had been urged to replace blowing of wells to remove water. Reasonable leakage had been placed at 300,000 feet per year per mile in 3-inch pipe under 100 pounds pressure for screw coupled line, 200,000 feet loss for rubber coupled, and 100,000 feet for welded line. Robert W. Hendee showed some years later that the rubber coupled line could be made much tighter than the above figure would indicate. The effect of dust in gas on measurement and compression was also studied at an early date in the fifth period.

Standardization Urged

In May of 1922, H. C. Cooper urged standardization in the natural gas industry. The gas companies were finding their sources dwindling rapidly, and matters concerning measurement of gas, efficiency of pipe line systems, prevention of leakage, and economy in labor and fuel in field operations had an increased effect on the earnings. Cooper pointed out that while gas was bought and sold by volume, there was no standard available to describe the cubic foot, each contract stating the particular pressure and temperature governing each case; the B.t.u. value referred indiscriminately to gross and net heating value; variations in determining specific gravity had an important effect in the results obtaining with the formulas; "gasoline content" of natural gas required a standard test, and there were no standards covering the desirable efficiencies of gas appliances. Standard methods for testing pipe lines for leakage, or covering specifications for fields and plant equipment were lacking.

In Report 5 of the Federal Oil Conservation Board to President Hoover, sources of natural gas losses were summed up as follows:

1. Losses in production: (a) Associated with oil; (b) not associated with oil.
2. Losses of residue gas (blown to the air at natural gasoline plants).
3. Losses in transportation (leakage from high-pressure natural gas transmission lines).
4. Losses in distribution and utilization.

Enormous Loss and Waste

In 1920 California produced 68,650,000,000 feet of casinghead and dry gas, of which 6,020,000,000 feet were wasted. In 1923 production was 319,262,000,000 feet and wastage 190,114,000,000 feet. In 1931 wastage dropped from 220,992,000,000 feet in 1930 to 68,478,000,000 feet. Wastage from 1920 to the end of the first quarter of 1932 totaled 1,233,309,000,000 feet in California. Complete statistical data on losses for Oklahoma were not available but the Oklahoma City Field alone was estimated to have wasted an average of 300,000,000 feet a day in 1930 and 1931. Texas figures were not available, but losses were enormous. The board estimated that residue gas from all natural gasoline plants in the Oklahoma City Field totaled 405,000,000 feet a day, of which half was blown into the air. California gasoline plants were shown to have cut loss of residue gas from 18,048,000,000 feet in 1929, and 19,526,000,000 feet in 1930, to 9,182,000,000 feet in 1931, and 2,152,000,000 feet in 1932. The month of April was the period taken in each year.

Lost and unaccounted for in natural gas distribution were ascribed to the following sources: (1) Errors in totalizing meters; (2) stolen gas; (3) effect of temperature and pressure on all measurements; (4) errors in customers' meters; (5) gas losses in blowing drips during construction work, etc.; (6) condensation; (7) gas losses in blowing holder seals; (8) leakage from mains and services.

One of the earliest revelations of the enormous waste of natural gas in domestic utilization was that made by Andrew M. Rowley in April of 1922. Writing in The Oil and Gas Journal, he pointed out that domestic consumers of natural gas in the United States were paying yearly for 150,000,000,000 feet burned in homes and from which there was no service due to improper appliances. If this amount of natural gas were replaced by artificial gas, which has only half the heating value, at $1.25 per 1,000 feet, it would cost $375,000,000, or more than $1,000,000 a day. Methods of eliminating this waste were discussed in this article.

Conservation Program

In May of 1922 the Journal published the resolutions adopted by the national committee on natural gas conservation. The conference was called by Franklin K. Lane, secretary of the interior. Recommendations included the following: Restriction of industrial gas sales; elimination of daylight burning of outdoor lamps and flambeaux; discontinuance of low set burner cooking stoves; discontinuance of service to wasteful users; closer check in the leakage problem; more intensive and extensive use of natural gas compressors; recording of gas distributing pressure in inches of water instead of ounces per square inch (1.7 inches equaling 1 ounce); prohibition of suction fans or vacuum pumps on consumers' lines; manufacture of carbon black only when gas is produced in isolated sections without present or prospective natural gas market.

Laying gas line

By the end of 1922 most of the natural gas companies had installed plants for the removal of natural gasoline from the gas before going into the pipe line, to eliminate troubles caused by gasoline in the lines. The consumers opposed this move on the ground that the B.t.u. was lowered, but the Bureau of Mines showed that the heating value thus removed was scarcely 2 per cent.

Natural gas progressed from an interesting curiosity to a source of illumination. The lighting power of gas was increased six-fold with the advent of the improved Welsbach impregnated mantle in 1890, but the end was marked by the electric light invention of Thomas A. Edison. Gas came into general use for heating and cooking in 1885, and into industrial use outside of the gas region manufactories of the Appalachian district as late as 1900. Central plant house heating came in 1915 when the gas refrigerator was invented. The gas refrigerator made little progress until after 1926. Possible utilization of natural gas studies provided an entirely new view of natural gas in 1930 when the U. S. Geological Survey presented a chart showing some of the chemical products which might be derived from natural gas. Primary products of oxidation included water gas, hydrogen, methyl alcohol, acetone, formaldehyle; of chlorination, methyl chloride, methylene chloride, chloroform, carbon tetrachloride; of pyrolysis, hydrogen, ammonia, ethylene, ethyl alcohol, ethylene chloride, ethylene glycol, propylene, propyl alcohol, butylene, butyl alcohol, anthracene, alizarin, naphthalene, indigo, acetylene, acetaldehyde, butadiene, synthetic rubber, benzene, resorcinol, toluene, saccharin, xylene, and carbon black.

Big Movement in 1931

The banner year in interstate movement of natural gas was 1931. The largest single shipment from one state to another was that of West Virginia to Ohio, 50,925,000,000 feet. The second largest was the movement of Louisiana gas to Texas, 41,520,000,000 feet. However, it was in new pipe line service that 1931 is outstanding, as the above mentioned interstate shipments are about 10,000,000,000 feet under the respective totals for 1930. Natural gas pipe line additions in 1931 included the Natural Gas Pipe Line Co. of America line from the Texas Panhandle through Kansas, Nebraska and Iowa, to Chicago; the Panhandle-Eastern Pipe Line Co., from the Panhandle to Indiana via Kansas, Missouri and Illinois; Northern Gas & Pipe Line Co. from Panhandle and Hugoton Fields to Nebraska, Iowa and Minnesota; Columbia Gas & Electric Co. line to Washington, D. C., and suburban areas in Maryland and Virginia. In California a 26-inch gas line was laid in 1931 from Kettleman Hills Field to the Los Angeles district. In the old gas region development of the Tioga Field in Pennsylvania was followed in 1931 by the laying of a 50-mile 14-inch line to Williamsport, Pa.

Pipe Line Growth

The year 1929 started the rapid growth of our national network of natural gas pipe lines with the following completions: Monroe-Richland (Louisiana) to Shreveport, 140 miles; to Atlanta, 450 miles, and to St. Louis, 450 miles. Lea (New Mexico) to El Paso, 200 miles. Bruni-Mirando (Texas) to San Antonio, 230 miles. Refugio (Texas) to San Antonio, 120 miles. Panhandle (Texas) to Dallas and Fort Worth, 350 miles; to Kansas City, Mo., 450 miles. Jennings (Texas) to Monterrey, Mexico, 165 miles. Kettleman Hills (California) to San Francisco, 300 miles; to San Joaquin Valley, 100 miles. Baxter Basin (Wyoming)-Hiawatha (Colo.) to Salt Lake City, 250 miles; and Clarksville (Ark.) to Little Rock, 100 miles. Construction was start-

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or barrels in a tank
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ed in 1929 on the following projects: Kettleman Hills to San Francisco-Sacramento, 400 miles; Glendive (Mont.) to Williston, N. Dak., 175 miles; Clarksville (Ark.) to Nashville, 400 miles; San Juan (N. Mex.) to Albuquerque and Santa Fe, 200 miles; Medicine Lodge (Kans.) to Grand Island, Neb., 360 miles; Maljamar (N. Mex.) to Clovis, 140 miles; Oklahoma City to Perry, 60 miles; Atchison, Kans., line extension to Falls City, Neb., 60 miles; Lyons, Kans., line extention to Superior, Neb., 120 miles.

AND THAT'S WHAT'S THE MATTER WITH HANNAH!

The hostility that now and then manifests itself between the small operator and the big one is nothing new. For instance, here's a resolution adopted in January, 1873, by small oil producers along the Clarion River in Pennsylvania:

"Resolved, that in consideration of the position taken by the 'large producers' in the matter of the combination, the 'small producers' of Clarion County do hereby resolve that we, the said 'small producers,' don't care a damn for the combination or for the 'large producers' or for anybody else, and that's what's the matter with Hannah."

The first attempt of the U. S. Geological Survey to number the producing gas wells in the United States was in 1929, when the total was found to be 53,545, not including wells producing oil also, distributed as follows: Arkansas, 150 wells; California, 75; Colorado, New Mexico, Utah and Washington, 40; Illinois, 85; Indiana, 1,110; Iowa, Missouri, North Dakota and South Dakota, 20; Kansas, 3,930; Kentucky and Tennessee, 1,240; Louisiana and Mississippi, 1,030; Michigan, 25; Montana, 140; New York, 2,150; Ohio, 6,500; Oklahoma, 3,060; Pennsylvania, 19,770; Texas, 1,500; West Virginia, 12,600, and Wyoming 120.

In October of 1931 H. O. Caster presented the following estimate of gas reserves in the principal fields: Panhandle (Texas), open flow, 12,254,000,000 feet; reserve gas, 10,312,000,000,000 feet; produced to date, 1,000,000,000,000 feet; productive and proven acreage, 1,289,000. California (state), open flow, 1,100,000,000 feet; reserve gas, 7,000,000,000,000 feet; productive and proven acreage, 75,000. Kettleman Hills, open flow, 250,000,000 feet; reserve gas, 5,000,000,000,000. Hugoton Field (Kansas-Oklahoma), open flow, 800,000,000 feet; reserve gas, 6,000,000,000,000; produced to date, small amount; productive and proven acreage, 1,000,000. Monroe (Louisiana), open flow, 4,435,000,000 feet; reserve gas, 2,712,000,000,000 feet; gas produced to date, 1,400,000,000,000 feet; productive and proven acreage, 250,000. Southeast New Mexico, open flow, 367,000,000 feet; reserve gas, 1,521,000,000,000 feet; gas produced to date, small amount; productive and proven acreage, 100,000. Southwest Wyoming, open flow, 683,000,000 feet; gas reserve, 560,000,000,000 feet. South Central Kansas, open flow, 971,000,000 feet; reserve gas, 280,000,000,000 feet; productive and proven acreage, 15,000. Oklahoma City, open flow, (?) very large; reserve gas, 253,000,000,000 feet; productive and proven acreage, 10,300. Central Wyoming, open flow, 744,000,000 feet; reserve gas, 200,000,000,000 feet; fields in area, 11. Tioga Pennsylvania), open flow, 404,000,000 feet; gas reserve, 100,000,000,000 feet; gas produced to date, small amount; productive and proven acreage, 4,500. Jackson (Mississippi), open flow, 1,134,000,000 feet; reserve gas, 25,000,000,000 feet; productive and proven acreage, 3,200. Wayne-Tyrone (New York), open flow, 286,000,000 feet; gas reserve, 16,500,000,000 feet; production to date, small amount.

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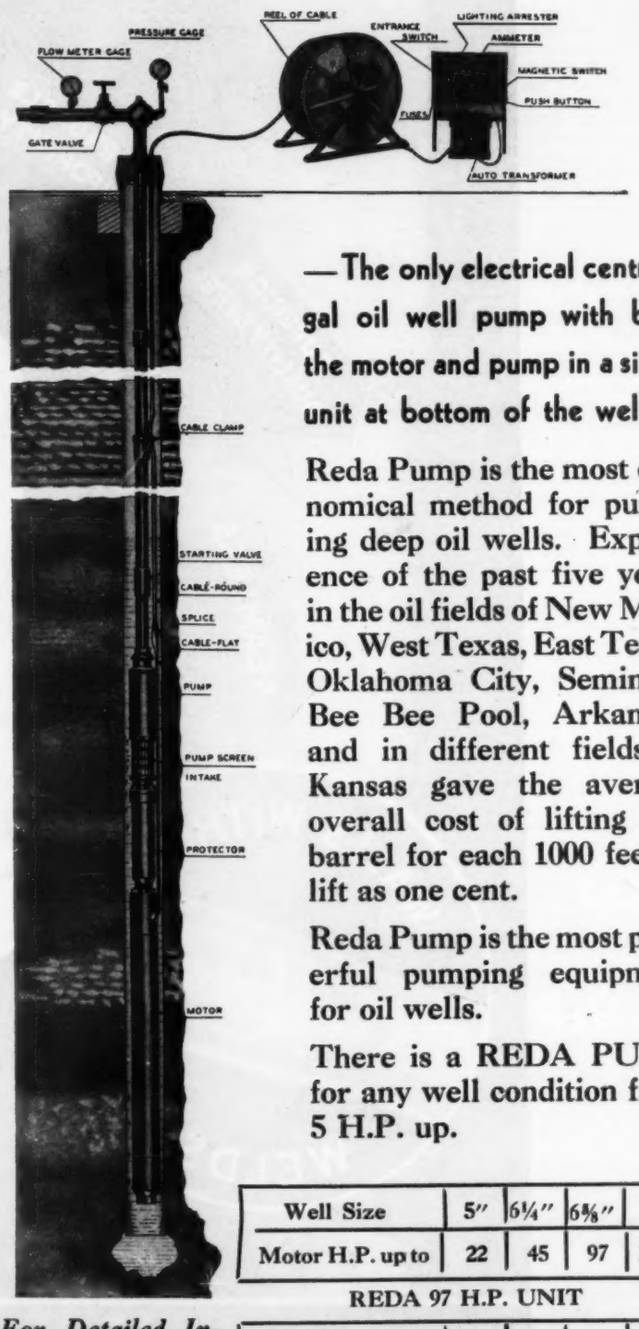

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Cap. B.P.D.	900	1,300	2,200	4,000

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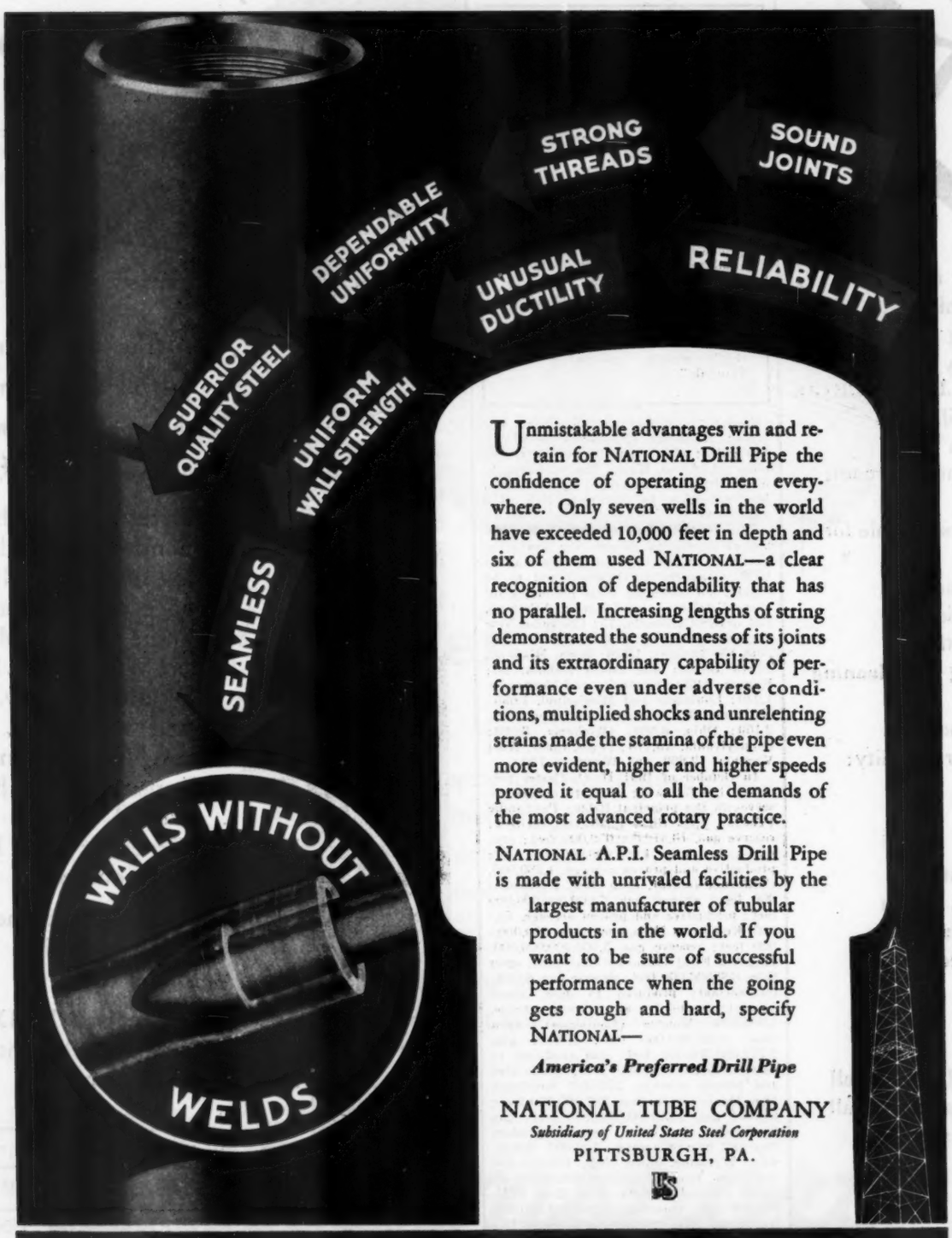

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NATIONAL A.P.I. SEAMLESS DRILL PIPE

ENGINEERING ERA IN OIL PRODUCTION PRACTICE BROUGHT MANY IMPROVEMENTS

DEVELOPMENT—ERA NUMBER 5 1919-1934

Like all great American industries that deal in necessary commodities the petroleum industry has passed through several stages of development, but it may be said that in the last 15 years it has entered the "engineering era." Prior to the time when technically trained men entered the production division of the business the direction of company affairs had rested largely with men who had been trained in the field, men who had grown up with the industry and were for the most part "practical" operators.

But as the older operators began to expand and their business grew, and their success attracted others into the industry, there came a time when competition advanced from the battle of wits to the employment of heavier and heavier machinery. This desire to find mechanical means of producing more oil in a shorter time led the executives of many companies to employ trained engineers to assist the production men and once started the race for volume of oil constantly increased.

The U. S. Bureau of Mines was the pioneer organization in the application of engineering principles to the production of oil. A check of the early technical papers and bulletins issued by the engineers employed by the government in this bureau clearly indicates the trend of production engineering.

The first effect of the engineering study was to point out to the executives that the amount of oil they could deliver to the pipe lines could be increased by conservation methods applied aboveground. Better storage was provided, well head connections and pipe lines on the lease were installed with more care, the wells were finished with casing properly set to reduce water intrusion and the condition of the bottom of the hole was checked frequently to determine whether maximum flow of oil into the well was being maintained. Plugging off bottom water was practiced and most of the oil producing states had laws that made it necessary that care be taken to prevent salt water from escaping into the oil formation.

Field Activities

Over 900 new oil fields were discovered during the fifth period of the petroleum industry in this country. Out of a total of over 2,200, more than 40 per cent of all fields in this country were discovered during the last 15 years.

The following table is taken from the records of The Oil and Gas Journal showing total number of completions, with percentage of oil wells to completions for each year.

Year—	Total completions	Oil wells	Per-centage
1920	34,019	24,278	71.5
1921	22,008	14,666	67.5
1922	24,814	17,332	69.8
1923	24,786	16,206	65.5
1924	21,894	14,771	67.5
1925	25,623	16,558	64 7
1926	29,319	19,013	65.0
1927	24,143	14,442	60.0
1928	22,321	12,526	56.0
1929	26,356	15,572	59.3
1930	21,240	11,640	54.7
1931	12,432	6,788	55.5
1932	15,021	10,444	69 5
1933	12,312	8,068	65.8
1934*	8,292	5,822	70.5
Total	324,590	208,126	64.25
Total 1859-1934	873,531	627,331	72.0

Deeper drilling and exploration of areas for hidden structures or pools is the order of the day and several holes have been completed below 10,000 feet within the past year, with two over 11,000 feet deep.

As petroleum engineering advanced the subjects studied were more and more technical and funds were made available for research work dealing with heavy formation pressures and the solubility of gas in the oil under such natural conditions.

The work of research in petroleum was financed through a fund for scientific research in petroleum geology, physics and chemistry established by John D. Rockefeller on November 15, 1925, under the auspices of the American Petroleum Institute. Commencing with 1926, annual installments of $50,000 each were made available from the $250,000 fund. An additional $250,000, similarly payable in $50,000 annual installments beginning in 1926, was made available to the Institute by Universal Oil Products Co., of Chicago, in furtherance of the same program.

Engineering Advancements

While many methods and processes commonly used in exploratory work and in drilling for and producing oil and gas were known to the older operators, general conditions did not make the application of these principles of engineering necessary. As engineering science has been adapted to oil field conditions and it has been proven that economical results can be secured by the use of more modern methods, their use has expanded.

Oil field geology as practiced in the early part of this century was a relatively simple means of outlining surface and underground structures in advance of drilling, and geophysical methods were introduced experimentally into the Gulf Coast in 1922. In 1924 the discovery of the first salt dome as a result of geophysical surveys was recorded, and from that time on the science has been developed and is now quite generally used to map hidden structures.

Geophysics, in its broader sense, is the science of earth physics, and includes geology, meteorology, geodesy, seismology, oceanography and a host of other sciences. In a more restricted sense as applied to the petroleum industry, it is the science of determining the existence, structure and composition of rocks buried in the earth's crust by the measurement of physical effects resulting from them.

The four principal geophysical methods used in prospecting for oil are magnetic, gravimetric, electric and seismic. In actual operation all geophysical exploration consists of two distinct and equally important steps—the measurement of physical effects, and the translation of such data into geologic terms.

Magnetic Method

The earth's normal field is uniform over areas of homogeneous structure. If difference exists in the subsurface structure, the normal or uniform field is distorted by an amount which depends, among other things, upon a factor called the magnetic susceptibility of the materials comprising the subsurface, and the relative masses, configuration and arrangement of those various component materials. A study of the earth's magnetic field at the surface, therefore, furnishes a means of predicting the subsurface structure and conditions.

The relationship of differential permeability to distortion in the earth's field brings out the fact that the magnitude of these anomalies may range from the infinitesimal to the enormous. Field instruments have been devised which measure anomalies through only a portion of that range. Different instruments are adapted to measure different portions. Some of the instruments which have been adapted to or devised especially for geomagnetic use are the ordinary compass, the dial compass, the Swedish dip needle, the ordinary dip needle, the portable magnetic theodolite, the Thomson-Thalen magnetometer, the Thalen-Tiberg magnetometer, the Schmidt field balance, the Haalck universal variometer, the Scherin-Wild earth inductor, the Hotchkiss Superdip, and others. New instruments and new types of instruments are being worked on continually. The Schmidt-Lloyd variometer (a type of magnetometer) was first imported to this country in March, 1924, for use in the oil fields.

Gravity Methods

Variations in the earth's normal or regional gravitational fields are the result of unequal distribution of masses of rock of various and substantially different specific gravities in the earth's crust.

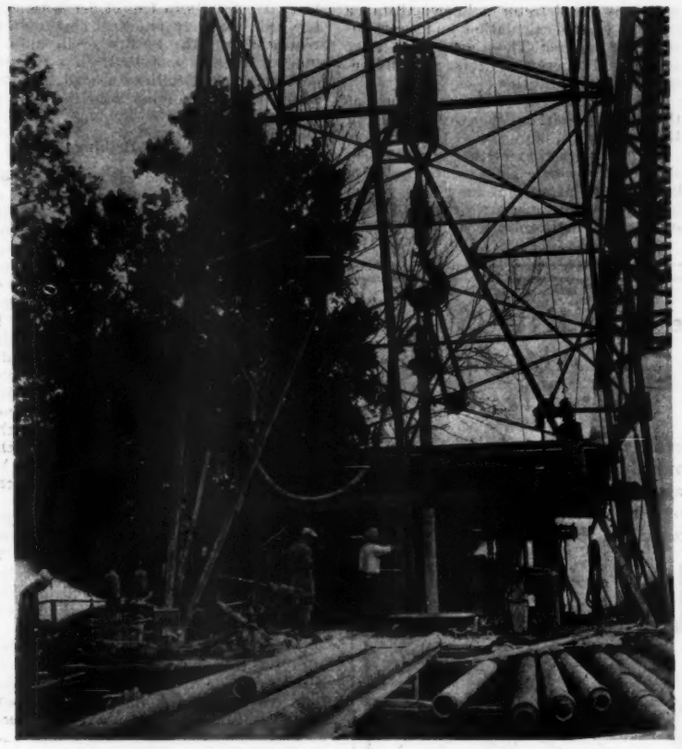
Two methods are available for determining gravity variations. The older pendulum method, depending upon determination of the period of oscillation of a pendulum, determines absolute gravity.

The Rycade Oil Co. and the Shell Petroleum Corp. introduced the torsion balance into the Gulf Coast about 1922, initiating the period of torsion balance exploration.

The newer and more widely used torsion balance method is a differential method which determines the direction and magnitude of the gravity gradient or the horizontal rate of change of gravity and "differential curvature," a complex mathematical concept of a function of gravity—a quantity proportional to the difference of curvature of the equipotential surface in the direction of greatest and least curvature—often of value in differentiating between shallower and deeper effects.

Pendulum determinations of gravity have been made over a widely spaced net covering most of the earth, and upon them have been based the determination of the form of the geoid, the development of the theory of the isostasy, and the beginning of the science of determination of distribution of rock masses from the interpretation of gravity anomalies.

The torsion balance system used in the oil field work is based on the Eotvos principle and the balance consists essentially of a torsion wire suspended at its upper end and carrying at its lower end a freely swinging horizontal aluminum bar. A gold or platinum weight is fastened at one end of the bar and an equal weight is suspended by a fine wire from the other end of the bar. If a



Typical drilling outfit of fifth era. Light rotary outfit of modern design

horizontal moment of rotation acts on the weights, the bar tends to rotate and to twist the torsion wire; the latter tends to resist the torsion, and the balance bar comes to rest when the resistance of the wire to torsion is equal to the torque. If the rotation of the wire is small, the resistance of the wire is directly proportional to the angular amount of the torsion.

The torque necessary to twist the torsion wire through any given angle can be determined in the laboratory and a coefficient of torsion can be calculated for the wire. If an unknown torque causes a rotation of the bar and if the torsion coefficient of the torsion wire is known, the magnitude of the torque can be determined by measuring the angle through which the balance bar has turned.

The only practical improvement that has been made in Baron Eotvos' original design of the essential working system of the torsion balance is the Z-shaped balance bar introduced by Schweydar of Berlin. The balance bar has roughly the shape of a "Z" on its side in a vertical plane; and the weights are fastened rigidly to the ends of the upper and lower arms of the "Z," the torsion wire is thereby lowered without lowering the center of gravity of the instrument. Various other modifications of the balance have been designed and are being worked on.

Electrical Methods

There are a variety of electrical methods that have met with success in the mining industry and have been used to lesser extent in prospecting for oil than the three other major methods of geophysical surveying, although they have demonstrated their usefulness in mapping salt domes, faults in the mapping of salt-water tables, and in determining the structure of certain sedimentary beds of marked conductive or resistance qualities.

Seismic Methods

The sonic or seismic method, in its present state of development consists essentially of the generation of elastic waves in the earth's crust by the explosion of dynamite, the recording of the time of initiation and arrival of such waves at the detector a known distance away, and the calculation and interpretation of results. There are two distinct schemes of survey by this method—refraction and reflection.

The Marland Oil Co. began the use of the seismograph on the Gulf Coast in 1924.

By the refraction method a profile is shot from a single shot point, recorders being placed at various known distances in a direct line away. From the data so obtained, a time-distance curve is constructed, as is commonly done in the study of earthquakes, and from this curve can be determined the approximate depth of the refracting formation and its exact velocity of wave transmission. This geo-velocity is characteristic and, under favorable conditions, diagnostic.

The reflection method consists of shooting and in recording on a detector a relatively short distance away the elastic waves reflected from suitable formations in the subsoil. From the known or determinable geo-velocity of the intervening rocks and the determinable length of the travel path, the depth to the reflecting formation can be computed accurately. The securing of reflection records requires much greater skill and care, and much more careful checking, than refraction records. The chief advantage of the sonic or seismic methods are that they give results in feet of depth to some key bed; that any practical depth can be reached; that the results admit only of unique solution and that, in refraction surveys, geo-velocities are determined which serve as an index to the type of rock encountered.

Methods of Drilling

Drilling for oil and gas may be classified into two main groups, known as churn drilling methods and rotary methods. There are several methods classified as "churn drilling" but the American cable tool "standard" rig and portable cable tool rig are the only ones used to any extent in this country at this time.

The cable tool method, whether in standard rig or in a portable outfit, consists essentially of making hole by raising a string of tools attached to the end of a walking beam and then allowing them to fall free and in this way pounding and fracturing the rock. By the rotary method the hole is drilled by the bit boring into the formation, aided by the circulating fluid which carries the cuttings out of the hole.

With the cable tool system it is customary to set successively smaller diameter strings of casing as the hole is drilled deeper and formations carrying gas or water are penetrated and it is desirable to prevent the gas or fluid from escaping into the drilled hole.

Fewer strings of casing are required with the rotary process of drilling than with the cable tool method as the mud fluid circulated down through the hollow drill pipe and up in the annular space between the outside of the drill pipe and the drilled hole tends to enter the porous formations and seal the pores, preventing escape of gas, oil or water into the hole.

Improvements in cable tool drilling in recent years have consisted primarily in building heavier equipment suitable for the deeper holes to be drilled. However, the rotary drilling method has been so improved and equipment made available suitable to drill any class of hole quickly and cheaply that at this time cable tool operations are confined almost entirely to relatively shallow operations and for clean-out work. The ability to rig up on a cable tool well in less time than it takes to set up the larger, modern rotaries permits the use of either standard or portable cable tool outfits in drilling wells to about 4,000 feet, but below that depth the rotary is usually used in either proven or wildcat territory.

Crooked Holes

Crooked holes may occur in well drilling by any method but it was not until the rotary method was used extensively in the rush to develop Seminole, Okla., area in 1926-27 and primarily because greater drilling speed could be made by the use of this method, that badly deflected holes were noted and methods devised to prevent such crooked holes being drilled.

The causes of crooked holes in rotary drilling may be summarized as the urge for speed in drilling; carrying too much weight on the bit, which causes the drill pipe to spring or to bear against one side of the hole; using drill pipe of too small a diameter; carrying too great a pressure of mud fluid, or using too powerful mud pumps, causing "hydraulicking" of the mud as it emerges from the hole in the bit, gouging out openings in the walls of the hole which the bit can enter and thus be deflected.

If mud fluid that is not properly mixed is used, and it is too light or too heavy, deflection of the hole will occur; using sprung or bent drill pipe; "spudding" the bit; entrance of the bit into a core hole "off center" after a core has been taken, and passing from a soft to a hard and inclined formation without lightening the pressure on the bit.

Shutdowns may cause crooked holes, for during such periods the hole may cave and when the string of tools is run into a cave it may deflect the course of the hole. The hole may also be deflected by the bit entering faulted and fissured formations, caverns and striking boulders.

The operators have ceased to insist upon the contractors making footage regardless of the kind of hole drilled and most drilling contracts drawn since 1929 have contained a clause limiting the amount of accidental deflection that may occur and permitting the owner's agent to enter the derrick at any time upon due notice to survey the hole to determine its verticality.

When the agitation to correct drilling methods was at its height a few years ago numerous inventors developed instruments for surveying drilled holes. The acid bottle was the first and simplest form and the types of surveying instruments ranged from that simple device to gyroscopic compasses and photographic films for recording records of the hole's path. These later instruments recorded both azmuth and amount of departure from vertical and by mapping the results it is possible to accurately trace the hole's path from surface to bottom.

In drilling with cable tools the completion of the wells below high-pressure formations presented a serious problem in the early days but with the advent of the U. S. Bureau of Mines into the industry to assist in solving field problems it was not long before mud fluid was being used successfully to control the high pressure gas and water sands above the producing formations that were penetrated by the drill.

When the rotary method was gaining popularity the problem of setting and successfully cementing casing was encountered and A. A. Perkins of Maricopa, Calif., developed and patented a double plug process in March, 1910, that was further developed by Erle P. Halliburton in 1914 in the Duncan, Okla., Pool, who was also issued patents, and these two methods are generally used to force cement behind the string of casing after it has been run into the drilled hole, and for other cement jobs.

To run the pipe into the hole that had been drilled by the rotary system and therefore is full of drilling mud presented some problems but they are solved by the use of guide shoes and float collars. The float collars are provided with back pressure valves and the mud is excluded from the inside of the casing string while it is being lowered into the hole. This has a tendency to lighten the load upon the derrick because of the buoyancy effect created by displacing the mud as the casing sinks through it.

The cementing process has been developed so a string of pipe over 10,000 feet long has been successfully set in Gulf Production Co.'s No. 103 McElroy test in Upton County, Permian Basin, West Texas. Many strings longer than 8,000 feet have been set and this important development makes possible the completion of wells to any economical depth.

Drill Bits and Accessories

To drill deep holes such as in Oklahoma City Field by the rotary method it has been necessary to develop additional heavy duty equipment to withstand high pressures built up in slush pumps to penetrate hard formations found at great depths and to prepare the mud fluids so that they will perform their several functions properly and permit the control of the upper formation pressures as penetrated that contain gas, water and perhaps oil that would cause considerable

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trouble if permitted to flow unrestricted into the hole.

Blow-out preventers are now available to permit the control of wells if they should start to come in suddenly. Heavy gate valves for christmas tree fittings are also available in several types and all equipment needed for the deepest wells can now be had in standard makes.

The fishtail bits are still used extensively, some faced with hard surfacing substances. The cone and roller bits have been developed to meet all kinds of drilling conditions and for all sizes of holes. Besides the cone and roller bits there are several other patented type bits all developed to drill deep, straight rotary holes economically.

A weight indicator to regulate pressures upon the drilling bits has been developed and improved so that it now includes recording instruments governing several other operations, all recording dials made visible to the driller from his station at the drawworks.

To drill holes in formations with comparatively low pressures into which formations mud fluids would enter if the regular rotary methods were used, a system of "pressure drilling" has been developed. It is described as the mechanical means of closing the annular space between casing and the drilling tools in order to enable drilling to be carried on with pressure applied to the hole at the surface. The drill pipe is lowered into the hole, as the bit penetrates the formation, by means of a hydraulic feed attached to the rotary turntable, with special packers and blow-out preventers engaging the drill stem at all times.

Electric motors are used in a novel hook-up that provides an automatic feed and weight control on the bit. Several units of this general type are available and they have been used successfully in several fields.

Rotary Unit Power

The modern rotary outfits are available in units that may be driven by high-pressure steam engines, electric motors, securing their current from power lines, with motors powered from plants that generate the electric power at the rig; Diesel engine-powered drawworks and slush pumps and oil engine driven units.

There are some portable rig outfits on the market and one or two combination cable tool and rotary units have been developed recently. These combination units are mostly intended for comparatively shallow holes where the upper formations can be drilled by rotary and the well finished with cable tools.

There have also been many improvements in cable tools and where they suit local drilling conditions they are being used, and they are especially well suited for cleanout and repair work at wells completed by either rotary or cable tool methods.

Completing the Well

Whether the hole is drilled by rotary or cable tools, it is quite essential that it be completed so that the gas and oil have easy escape into the bottom of the hole.

With cable tools the penetration into the producing formation is made slowly and as the hole is deepened the formation pressure helps to "drill" the well in in many instances.

Shooting a well into production is a very old practice but during the past 15 years the time bomb has been introduced into the industry by means of which the time when the explosion takes place is more definitely controlled by the shooter.

Sand tamping above the shot, developed in the Salt Creek Field, Wyoming, has given better results in many fields than the old form of fluid tamping.

Within the past three years the use of inhibited hydrochloric acid for completing and increasing the rate of production of wells drilled into limestone formations has been introduced and has met with great success.

The results of acidization of lime wells have created much interest in the possibilities of finding some similar method to be applied to wells producing from sand formations and this problem is now being worked upon by many interested parties.

The theory back of the use of hydrochloric acid as used in oil and gas wells is based upon the reaction between the acid and limestone during which process the lime is dissolved. The process as introduced into the oil fields in 1932 was adapted from acidization of brine wells in Michigan and its use has expanded to include most districts where production comes from limestone formations. The acid attacks the lime in the formation when introduced into the hole and in dissolving portions of it new channels are opened, permitting more ready escape of the gas and oil that had been dammed in pore spaces not open to the drilled hole..

To complete a rotary drilled well presents many problems especially where the bottoms of the holes are below 6,500 feet beneath the surface of the ground. The hydrostatic pressure induced by the weight of the column of mud fluid against the face of the producing formation as the drill penetrates into it often forces mud and water back into the pore spaces and partially or completely seals the gas and oil in the reservoir.

To overcome this there are several mud admixtures available that give the mud fluid the proper characteristics for drilling in. Where the formation pressures are so low that they could not withstand the pressure exerted by these special mud fluid columns salt water and specially prepared oil have been used to reduce the load against the face of the producing formation.

In the Big Lake Field, Reagan County, Texas, the formation pressure in the deep wells is so low that even clear water was not satisfactory for drilling in so the engineers in charge devised a method whereby the water is aerated by compressed air being forced into the drilling fluid as it enters the drill stem. This mixture of air and water so lightens the fluid column that it does not enter the low-pressure formation but does have carrying capacity sufficient to remove the cuttings from the hole as the bit cuts into the formation.

Special separators are supplied at the surface to handle the fluid returns and remove cuttings. An elaborate system of controls is provided at the well head and pressure drilling rotary equipment is used.

Well Head Fittings

Completing wells of any depth necessitates the installation of proper control valves and fittings at the casinghead. As the wells have been drilled below 6,000 feet and high-pressure formations penetrated, high pressure valves and fittings have been made available for all sizes of casing and tubing and rated up to 9,000 pounds working pressures.

These fittings and valves have been assembled into every conceivable arrangement to provide "christmas trees" to suit local lease conditions and meet the ideas of the operator owning the well.

High velocity streams of oil and gas carrying appreciable quantities of sand have frequently caused much trouble in completing or producing wells because fittings have been quickly cut away by the sand blast and the wells have been out of control for a time.

Engineers for manufacturers and production men have given much time and consideration to this problem and much progress has been made in providing suitable controls for high velocity, high-pressure wells making sand.

Wells out of control frequently catch on fire and the aid of experienced fire fighters is needed to put out the blaze and bring the well under control. Fires have been common to the oil industry ever since Drake finished the first well and "Uncle Billy" Smith went into the tank house to see if the open top wooden tanks were full of oil and carried an ordinary kerosene lamp. The fire that resulted destroyed pump house and derrick and the boarding house close by and since then oil and gas fires have been no uncommon occurrence in the oil fields.

The old volunteer fire fighting crews with rifles and cannon assisting the lease men have been superseded by trained fire fighters who frequently fly to the fire in airplanes and have placed at their disposal all kinds of modern equipment to clear debris from around the well and prepare to shoot out the fire with solid nitroglycerin and then cap the well or kill it as conditions necessitate.

High pressure oil and gas separators have also been developed to handle the production from high pressure wells, some provided with compartments to separate the sand from the oil.

The gas from the oil and gas separators usually is delivered into pipe lines for the natural gasoline plants and after the gas has been stripped of its gasoline it is recompressed and in some fields recharged into the formations from which the oil and gas was produced to help restore depleted pressure in the reservoir.

The gas is also used for gas lift in producing the oil.

While the air lift was suggested and used to some extent in the early fields of Pennsylvania and Ohio the use of the gas lift for oil production had its greatest impetus during the Seminole Pool development in Oklahoma.

Gas drive or repressuring has also been known of for some years but it has been brought to its highest state of development during the past 15 years.

The theory of gas lift has been stated as flow of oil induced or assisted by forcing compressed air or natural gas into the well under appropriate pressure and in sufficient volume, either down through the tubing or through the space between the flow tubing and the well casing, depending upon the path determined upon for the rising fluid. The gas so introduced becomes occluded or entrained in the oil, lightens or aerates the oil column and by its effort to expand, carries the oil with it to the surface.

To recharge the formation with gas compressed to approximately the original reservoir pressure involves control of formation pressures so that the dissolved gas in the oil does not come out of solution and the viscosity of the fluid is maintained so that it can move through the pore spaces in the formation easily to the low pressure areas at the bottom of the outlet wells.

Flooding

Through the accidental flooding of oil sands by failure to properly exclude water from wells, it was discovered in the Bradford, Pa., oil fields about 35 years ago that oil might be driven through the containing sand by water under pressure. Water introduced into one well until the fluid level is high enough to apply a suf-

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

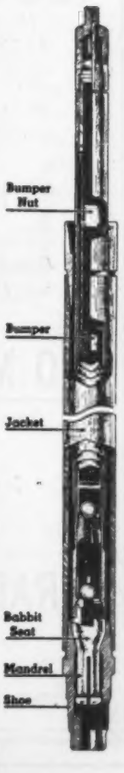
FORWARD with the Petroleum Industry

TEN years ago there was offered to the Petroleum Industry a pump which was revolutionary in its design, operation and efficiency.

TODAY, in every corner of the oil-producing world, FLUID PACKED PUMPS are the choice of many operators who figure *all* the elements of pumping cost.

THE FLUID PACKED PRINCIPLE consists of a "well-tested" design which provides 20/1000" diametrical clearance between tubes, to insure free telescoping and to minimize friction. The fluid being pumped fills the long, annular spaces and this "Fluid Packing" has proved to be an efficient seal in pumping wells of *any* depth.

LOOSE fitting of tubes means free sucker rod movement and minimizes rod breakage—"Fluid Packing" means less friction and abrasion—the elimination of cups, packing and tight-fitting parts saves pulling jobs—continuous, uniform pumping means greater ultimate production.



FLUID PACKED PUMPS are made in several types (including the modern Positive Pull Type, illustrated)—to meet every pumping requirement. We will gladly send you complete details and recommendations upon request.

FLUID PACKED PUMP CO.
BOX 64 • LOS NIETOS, CALIFORNIA • U.S.A.
MID-CONTINENT AND TEXAS DISTRIBUTION
FLUID PACKED PUMP CO.—MID-CONTINENT
2 S. E. 29TH ST., OKLAHOMA CITY, OKLAHOMA
Gulf Coast Headquarters: 409 Velasco St., Houston, Texas
London Office: Coventry House, South Place, London E.C. 2, England
A MODERN PUMP FOR MODERN CONDITIONS
Protected by Patents No. 1848474, 1848478, 1849178, 1921046; others pending.

ficient hydrostatic head on the oil sand, will cause the water to enter the sand and force its way toward other wells where lower pressures prevail. In doing so, the water must follow the more open channels in which large quantities of oil may be stored, and since oil and water do not readily mix, the oil is driven ahead of the water into the low-pressure wells.

Other Production Methods

Beam pumping, while common since the first wells were opened, is still used at the majority of wells in this country. The equipment has been greatly improved and there are many units available for various kinds of wells. These units are powered with gas or oil engines, driven from remote power plants by rod lines and operated by electric motors. They are made with strokes varying from a few inches to 10 feet and in some instances longer.

For deep well pumping many engineers advocate long stroke slow motion pumping units and small diameter working barrels set at the bottom of the tubing have been found to give high efficiencies. Liner type metal to metal surface working barrels have been developed during the last 15 years and have won favor in many fields. Sucker rods are made of special materials selected to give long life and continuous service.

There are many types of counterbalances available for pumping wells and some geared pumping units are equipped with rotary type counterbalances designed especially for the conditions under which the equipment is recommended for use.

Corrosion

Corrosion of lease equipment has given much trouble since the early days of the industry and in many fields the losses from this cause are appreciable but the engineers and manufacturers have done much to retard and in some instances practically eliminate the corrosion of well and lease equipment. Special metals have been used with good results and in districts where corrosion of steel tanks has been rapid wooden straight sided tanks have been used successfully.

Subsurface Pressure Instruments

To aid the production man and the engineer in determining underground conditions at any point below the surface of the well there are several pressure recording instruments now on the market and their use is now common to many fields and it is spreading so that in several new pools the regulations for producing the oil and gas are based largely upon data secured by the use of subsurface pressure instruments and bottom hole samplers.

Core Drilling and Sampling

The practice of securing cores of the formations as penetrated using either cable tool or rotary core barrels according to the type of drilling equipment used to secure the core has been developed into a successful process during the past 15 years. There are several types of core barrels on the market and it is now common practice for the owner of the well to require the drilling contractor to take cores of formations suspected of containing geological information of value.

Cleanout of Wells

The problem of cleaning out shallow holes has always faced the producer and the use of a light cleanout string of tools and bailer has long been common practice.

Within the past few years other methods of cleaning out wells have been developed and there are also several types of portable cleanout units available. These units usually mounted upon a truck bed are so built that the operators can back up to the well and pull rods and tubing and even string up light tools and bailer.

Other units are built to accommodate special type bailers some using the suction to draw cavings and debris into the upper compartment of the bailer to be hoisted to the surface. Other bailers called sandpumps are improvements over the old dart type dump bailers.

Recently the method of cleaning the wells by injecting compressed air or gas into the hole through a string of tubing run to the bottom and forcing the debris after it has mixed with fluid to the surface in the annular space between tubing and casing. This method is meeting with success in some of the deeper fields and is readily applied to any well. Proper cleaning of the bottom of the hole is very essential to good production and to lower production costs.

Treating Cut Oils

During the earlier life of the industry field men were satisfied, in most instances, to clean up oils by heating the mixtures and recovering such pipe line oil as could be separated. This haphazard procedure has not satisfied the engineers and production men of recent years and several methods of dehydrating and cleaning up emulsions have been developed.

Heat is still extensively used in treat-

GOOD!
EVERY LAST DROP...

NRA

. . . . and every drop
TRIPLE FILTERED

LOOK for the ORANGE-and-BLUE REFINERY-SEALED CAN

ALL PEN
ALL-WEATHER
MOTOR OIL

Every drop of wax-free ALL PEN Motor Oil comes from the Refinery-Sealed Can with all of its pure, clean, TRIPLE-FILTERED goodness.

Super-refined from only 100% BRADFORD-Pennsylvania Grade Crude, the finest crude in the world, ALL PEN brings to your motor many extra miles of "oilier" lubrication . . . for ALL PEN MOTOR OIL NEVER BREAKS DOWN.

NO MOTOR OIL LASTS LONGER

A New ALL PEN Improved
GASOLINE
Its EAGER POWER Gives "WINGS" to Your Motor

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Refiners of 100% Bradford-Pennsylvania Grade Crude Only

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Producers of Oil and Gas
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Tulsa, Okla.

Every User Says
"MORE FLUID AND LESS ROD TROUBLE,
since we started using
HAUSE
Drops and Seats"

Rods fall more freely without buckling under the speed necessary in large wells, when HAUSE Drops and Seats are used.

Valves open and close more quickly thus eliminating the jerk at ends of stroke.

Reversible—Made of Alloy Steel with Uniform Wall Thickness—Heat Treated.

Lighter Weight—Sealed Hollow Drop cannot spin out cage and lessens pounding out of seat—Longer Wear.

Recommended only for use with Hause Valve Cages.

THE HAUSE VALVE CAGE

No pipe wrench is required when making up the Hause Valve Cage, due to its unique ROD WRENCH SQUARE. This eliminates cup trouble, resulting from a rough cage scoring the inside of the working barrel.

The Hause Valve Cage is reamed smooth inside and slightly larger than the corresponding A. P. I. ball size, thus keeping the valve directly over the seat and causing faster seating.

Drop Forged from Nickel-Chromium Steel and Heat Treated for maximum strength and wear. More fluid area.

For Sale Through Your Supply Store

Descriptive Literature on Request

Hause Valve Company
Wichita, Kansas

emulsions but it is controlled by newly developed equipment and frequently special chemicals are added to the mixture to aid in the separation of oil and water.

Dehydration by the electrical methods which subject the oil-water mixture to either high-potential alternating current or a direct current of moderate intensity are being successfully used in many fields.

Petroleum emulsions respond to treatment with various chemical reagents which operate either to dissolve the films enclosing the water globules by direct solvent action, or by neutralizing the negatively charged water globules through the introduction of some readily adsorbed action.

Centrifugal methods of breaking down emulsions have been introduced within the past few years and have many places of application.

Electrical Coring

Within the past five years the production department of the petroleum industry in this country has come to use a method of electric coring developed in Europe to determine the lithological character of the rocks traversed by a drill-hole, by means of electrical measurements made inside the hole in its uncased part.

The industry has passed from the stage of every fellow for himself and rough and ready tactics to the use of available engineering talent and the application of recovery methods suited to the particular area. Old areas will be reconditioned to recover additional oil and this work will also be turned over to the engineer to carry out, so it may safely be assumed that the industry is well along in the final stage of development wherein orderly development and production will maintain to the good of those interested in the industry and to the users of the products.

OIL DISCOVERED 1920-1934

1920

State—	Field—
Pennsylvania	McCance
West Virginia	Marsh Fork
Kentucky	Alonzo
Kentucky	Bolt's Fork
Kentucky	Buchannon
Kentucky	Coops
Kentucky	Fugate
Kentucky	Hurt
Kentucky	Keaton
Kentucky	Keen
Kentucky	Martin County
Kentucky	Mitchell
Kentucky	M. M. Wall
Kentucky	Nourse
Kentucky	Oil Branch
Kentucky	Olmstead
Kentucky	Oneida
Kentucky	Pike County
Kentucky	Pelville
Kentucky	Pilot Knob
Kentucky	Walbridge
Kentucky	Wilhelm
Kentucky	Windy City
S. W. Indiana	Dennison
S. W. Indiana	Bowman
S. W. Indiana	Davidson
S. W. Indiana	Rumble
Illinois	Waterloo
Oklahoma	Alma
Oklahoma	Bruner-Vern
Oklahoma	Burbank
Oklahoma	Deaner
Oklahoma	Deer Creek
Oklahoma	Empire
Oklahoma	Jolly-Patton
Oklahoma	Frankfort
Oklahoma	Hanbury (Beaver)
Oklahoma	Madaline (21-10)
Oklahoma	Maramec
Oklahoma	Maud
Oklahoma	Mose Carr
Oklahoma	North Baltimore
Oklahoma	Oak Grove
Oklahoma	Oklahoma-Central (Dix)
Oklahoma	Olean
Oklahoma	Otstot
Oklahoma	Phillipsville
Oklahoma	Pole
Oklahoma	Poor Farm
Oklahoma	Prue (21-10)
Oklahoma	Red River
Oklahoma	Riverland
Oklahoma	Robberson
Oklahoma	Roff
North Texas	Ball
North Texas	Currie
North Texas	Earnest
North Texas	(Stephens County)
North Texas	Frankell
North Texas	Groesbeck
North Texas	Hilburn
North Texas	Norwell
North Texas	Okra
North Texas	Pioneer
North Texas	Sipe Springs
North Texas	Westbrook
Kansas	Arbuckle
Kansas	Beaumont
Kansas	Bush-Denton
Kansas	Cambridge
Kansas	Covert-Sellers
Kansas	Florence-Urschel
Kansas	New Salem
Kansas	Peabody
Kansas	Smock-Sluss
Kansas	Young
N. Louisiana	Bull Bayou
Texas	Blue Ridge
Texas	West Columbia
Wyoming	Werts
Montana	Cat Creek
California	Huntington Beach

1921

West Virginia	Ethel
Kentucky	Beauchamp
Kentucky	Belcher
Kentucky	Calvary
Kentucky	Grin
Kentucky	Peart
Kentucky	Penrod
Kentucky	Powell
Kentucky	Pugh
Kentucky	Reeder
Kentucky	Rochester
Kentucky	Sandidge
Kentucky	Satterfield
Kentucky	Simmons
Kentucky	Slanks
Kentucky	Vance Potter
Kentucky	Weaver
S. W. Indiana	Arthur
S. W. Indiana	Monroe City
S. W. Indiana	Rogers Station
Oklahoma	Bayou
Oklahoma	Bowring
Oklahoma	Continental
Oklahoma	Enfisco Morton
Oklahoma	Eram
Oklahoma	Lyons-Quinn
Oklahoma	Midwest
Oklahoma	Nuyaka
Oklahoma	Okemah
Oklahoma	Pollyanna
Oklahoma	Rainoln
Oklahoma	Tonkawa
Oklahoma	Webb
North Texas	Borger
North Texas	Carson County
North Texas	Byrd's Store
North Texas	Curry
North Texas	Minerva
North Texas	Mirando
North Texas	Mirando City
North Texas	Carolina-Texas
North Texas	Schott
North Texas	Texhoma-Gose
Kansas	Agard
Kansas	Colony
Kansas	Garnett
Kansas	Potwin
Kansas	Seeley
Kansas	Teter
Kansas	Virgil
Kansas	Welda
N. Louisiana	Bellevue
N. Louisiana	Shongaloo
N. Louisiana	Haynesville
Arkansas	Smackover
Arkansas	El Dorado
Arkansas	Irma
Arkansas	East El Dorado
Arkansas	Clarksville
Arkansas	Stephens
Arkansas	Alma
Texas	Pierce Junction
Wyoming	Enos Springs
Wyoming	Shoshone
Montana	Soap Creek
New Mexico	Ute
California	Santa Fe Springs
California	Long Beach
California	Los Cerritos

1922

Kentucky	Cable
Kentucky	Dyson
Kentucky	Morton's Gap
Kentucky	Penner
Kentucky	Pine Ridge
Kentucky	Rocky Hill
N. E. Indiana	Hotmire
Illinois	Friendsville
Illinois	Wamac
S. W. Indiana	Francisco
S. W. Indiana	Oatsville
Oklahoma	Brock (Crinervile)
Oklahoma	Buffalo Head
Oklahoma	Chickasha
Oklahoma	Country Club
Oklahoma	Doyle
Oklahoma	Foraker
Oklahoma	Garrison
Oklahoma	Hallett
Oklahoma	Hominy
Oklahoma	Mannford
Oklahoma	March (Amabel)
Oklahoma	New Cushing
Oklahoma	Perry
Oklahoma	Sayre
Oklahoma	Turkey Mountain
Oklahoma	Woolsey
North Texas	Aviators
North Texas	Chilton
North Texas	Cross Cut
North Texas	Dalmar
North Texas	Freeman-Hampton
North Texas	Hirschi
North Texas	Kosse
North Texas	Leaseholders
North Texas	Luling
North Texas	Ray
North Texas	Satterfield
North Texas	Yturri-Southon
Kansas	Blankenship
Kansas	Browning
Kansas	Leon-Weaver
Kansas	Polkinghorn

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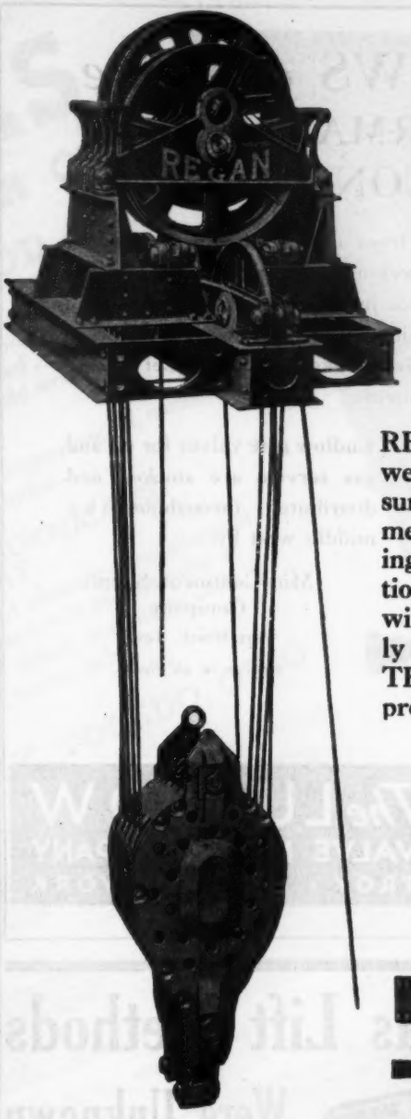
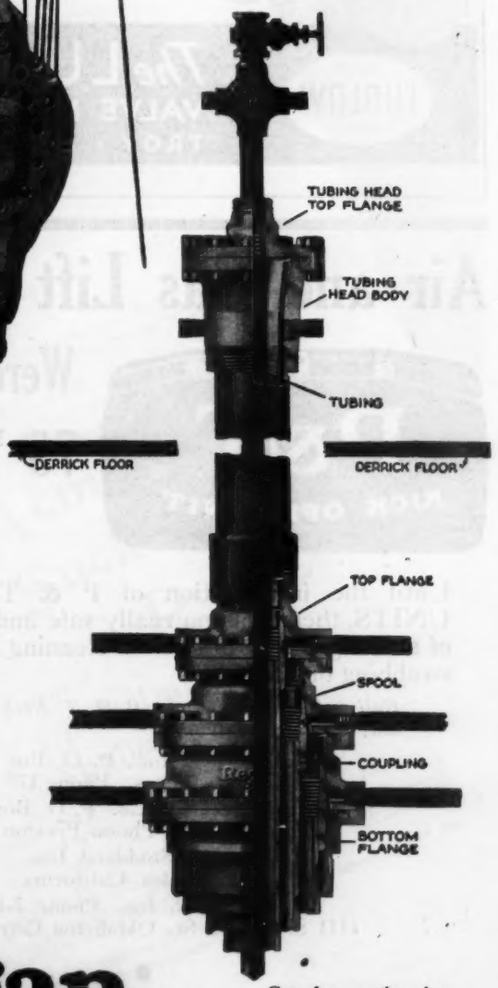


Regan Equipment never fails

REGAN pioneered deep well drilling and high pressure control equipment to meet every difficult drilling and production condition. REGAN equipment will be found on practically every deep well. PROTECT your wells with proven equipment.



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- Crown Blocks
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- Tubing Heads
- Control Heads
- Blowout Preventers
- Oil Savers
- Casing Hooks
- Swivels

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Oil Field Equipment

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Complete engineering service.
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Mid-Continent Representative:
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GEO. R. WOODS, Mgr., 17 Battery Pl.

LUDLOWS *combine* PERFORMANCE *and* ECONOMY

Performance comes from correct design, proven by actual field service over many, many years. *Economy* comes from experience in manufacture, experience in material selection which make Ludlows reasonable in first cost and negligible in upkeep expense. Let us estimate on your requirements.

Ludlow gate valves for oil and gas service are stocked and distributed throughout the middle west by

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Fort Worth, Texas
Offices in all fields.

TRADE LUDLOW MARK

The LUDLOW VALVE MFG. COMPANY
TROY . . . . NEW YORK

Air and Gas Lift Methods Were Unknown 75 Years Ago

Until the introduction of P & T KICK-OFF UNITS, there was no really safe and easy method of starting a well to flow or cleaning it out without swabbing or bailing.

Full information about P & T Kick-Off Units may be secured from:

Price-Trawick, Inc., P. O. Box 1611
Kilgore, Texas. Phone 179
Gulf Engineering Co. P. O. Box 182
Houston, Texas. Phone Preston 5890
Buck & Stoddard, Inc.
Los Angeles, California
Price-Trawick, Inc. Phone 7-1761
1111 S. E. 29th St., Oklahoma City, Okla.

Price - Trawick Inc.
STROUD OKLAHOMA

State—	Field—
Kansas	Rock
Kansas	Sallyards
N. Louisiana	Cotton Valley
N. Louisiana	Shongaloo (Gleason)
N. Louisiana	Sligo
N. Louisiana	Springhill-Sarepta
Arkansas	Smackover
Texas	Big Creek
Wyoming	Circle Ridge
Wyoming	Baxter Basin
Wyoming	Buffalo
Wyoming	Billy Creek
Wyoming	Black Mountain
Wyoming	Poison Spider
Wyoming	South Garland
Wyoming	Teapot
Montana	Kevin-Sunburst
New Mexico	Hogback
New Mexico	Rattlesnake
California	Torrance

1923

West Virginia	Elkhurst
Kentucky	Ida May
Tennessee	Willow Grove
Illinois	Armstrong
Illinois	Hoisen-Dorney
Illinois	Gillespie-Bend
S. W. Indiana	Barret
Oklahoma	Beebe
Oklahoma	Cromwell
Oklahoma	Josey
Oklahoma	Newman (Lamar)
Oklahoma	Otoe
Oklahoma	Papoose
Oklahoma	Pine Pool
Oklahoma	Pure
Oklahoma	Seltzer
Oklahoma	Sheridan
Oklahoma	Sholem Alechem
North Texas	Big Lake
North Texas	Carson
North Texas	Cartwright
North Texas	Hightower
North Texas	Ina
North Texas	Peters
North Texas	Peterson
North Texas	Shappell
North Texas	Sunshine
North Texas	Swastika
North Texas	Wilmont
Kansas	Bush City
Kansas	De Malorie
Kansas	Lamb
Kansas	Madison
Kansas	Pixlie
Kansas	Russell
Wyoming	Golden Eagle
Wyoming	Medicine Bow
Wyoming	Notches
Wyoming	Rex Lake
Wyoming	Simpson Ridge
Wyoming	Spring Creek
Colorado	Moffat
Colorado	Fort Collins
Colorado	Wellington
New Mexico	Artesia
California	Wheeler Ridge
California	Dominguez

1924

Pennsylvania	Campbell Farm
Pennsylvania	Perry Twp.
Pennsylvania	Punxsutawney
C.&S.E. Ohio	Syracuse
West Virginia	Sarah
West Virginia	West Union
West Virginia	Pratt
West Virginia	Hookersville-Opal
Kentucky	Buffalo Creek
Kentucky	Island Creek
Tennessee	Tinsleys Bottom
Tennessee	Bone Camp
S. W. Indiana	Tri County
Oklahoma	Alcorn
Oklahoma	Atlantic
Oklahoma	Bearden
Oklahoma	Braman (North & South)
Oklahoma	Chandler
Oklahoma	Donnelly
Oklahoma	Fuhrman
Oklahoma	Gillette
Oklahoma	Hubbard (Retta)
Oklahoma	Humble (Seay)
Oklahoma	Kendrick (Skellyford)
Oklahoma	Rood (Bethel)
Oklahoma	Ryan
Oklahoma	Stroud
Oklahoma	Thomas
Oklahoma	Tibbens
Oklahoma	Tuskegee
Oklahoma	Bilbo
Oklahoma	Billingslea
Oklahoma	Cox
Oklahoma	Deep Rock (Mehan)
Oklahoma	Devonian
Oklahoma	Donahue (Mashan)
Oklahoma	Duquesne
Oklahoma	Fairfax
Oklahoma	Harness
Oklahoma	Keefeton
Oklahoma	Nellie
Oklahoma	Oscar (Hambro)
Oklahoma	Red River
Oklahoma	Sarah Whipple
Oklahoma	Sunray
Oklahoma	Vernon
North Texas	Atlantic
North Texas	Bangs
North Texas	Barney Carter
North Texas	Carey
North Texas	Emerald
North Texas	Shenev
North Texas	Gambrell
North Texas	Harmel
North Texas	Henne-Winch-Faris
North Texas	Cole
North Texas	Ira
North Texas	Litchfield
North Texas	Olden
North Texas	Orton
North Texas	Ragle
North Texas	Bains Creek
North Texas	Richland
North Texas	Adams
North Texas	South Vernon
North Texas	Woodbine Shallow Field

State—	Field—
North Texas	Stubblefield
North Texas	Waite Phillips
North Texas	Wortham
Kansas	Buffalo
Kansas	Canary
Kansas	Coleman
Kansas	Eastman
Kansas	Fairport
Kansas	Graham
Kansas	Kars-Wilkins
Kansas	Liberal
Kansas	Rainbow Bend
Kansas	Slick-Carson
Kansas	Smith
Kansas	Welsh
N. Louisiana	Waskom
Texas	Kingsville
Texas	Long Point
Texas	Nash
Texas	Orchard
Louisiana	Lockport
Wyoming	Arminto
Wyoming	Bell Springs
Wyoming	Crooks Gap
Wyoming	Eight Mile Lake
Wyoming	Rock River
Wyoming	Steele Creek
Montana	Bowes
Montana	Cut Bank
Montana	Lake Basin
Colorado	Carbonera
Colorado	Iles
Colorado	Tow Creek
New Mexico	Bloomfield
Utah	Cisco
California	Newport
California	Rosecrans
California	Inglewood

1925

Pennsylvania	Morris Twp.
West Virginia	Granny Creek (Stockly)
West Virginia	Scott
West Virginia	Big Injun
Kentucky	Crocus Creek
Kentucky	Kettle Creek
Kentucky	Proctor
Kentucky	Pulsey Creek
Tennessee	Celina
Tennessee	Clark
N. E. Indiana	Washington
N. E. Indiana	Maumee Twp.
N. E. Indiana	(Jennings County)
Illinois	Kogan-Stillwell
Oklahoma	Bass
Oklahoma	Blue Ribbon
Oklahoma	Bowlegs
Oklahoma	Bu-Vi-Bar
Oklahoma	Crescent (Lovell)
Oklahoma	Earlsboro
Oklahoma	Jolly-Ogg
Oklahoma	Micawber
North Texas	Benavides
North Texas	Blake
North Texas	Burkett
North Texas	Burns and Maxon
North Texas	Camp Texhoma
North Texas	Cross Plains
North Texas	Hutchinson
North Texas	Ickert
North Texas	Lytton Springs
North Texas	McCamey
North Texas	Iatan
North Texas	Megargel
North Texas	Mercer
North Texas	Mills
North Texas	Muse-Robertson
North Texas	Noble
North Texas	Nocona
North Texas	North Cisco
North Texas	Powell
North Texas	Rock Creek Crossing
North Texas	Sun
North Texas	Taylor Pool
North Texas	Wheat
North Texas	Wolfe
Kansas	Atyeo
Kansas	Big Lake
Kansas	Climax
Kansas	Keighley
Kansas	Kramer
Kansas	Laton
Kansas	Lipps
Kansas	Lost Springs
Kansas	Scott
Kansas	Padgette
Kansas	Teeter
Kansas	Quincy
Kansas	Wiggins
Kansas	Rainbow West
N. Louisiana	Urania
Arkansas	Bradley
Arkansas	Clarksville
Texas	Clements
Texas	High Island
Texas	South Liberty
Wyoming	Gebo Dome (Lucerne anticline)
Wyoming	Lake Creek
Colorado	Douglas Lake
Colorado	Thornburg
Colorado	Garcia
New Mexico	Table Mesa
Utah	Moab (Cane Creek)
California	Sonoma Co. (Petaluma

1926

Pennsylvania	Ambrose
Illinois	Jacksonville
S. W. Indiana	Sicai
S. W. Indiana	Vigo-Sullivan
Oklahoma	North Allen
Oklahoma	Oklahoma City
Oklahoma	Roundup
Oklahoma	Searight
Oklahoma	Seminole
Oklahoma	Sopasco
Oklahoma	Steedman
Oklahoma	Texhoma
Oklahoma	Woyd
Oklahoma	Zea
North Texas	Adams
North Texas	Albany
North Texas	Alworth
North Texas	Belle Plains
North Texas	Boren Farm

(Continued on Next Page)

In 1892 ... JONES
THE PIONEER MANUFACTURER OF THE FIRST IRON SUCKER ROD ....

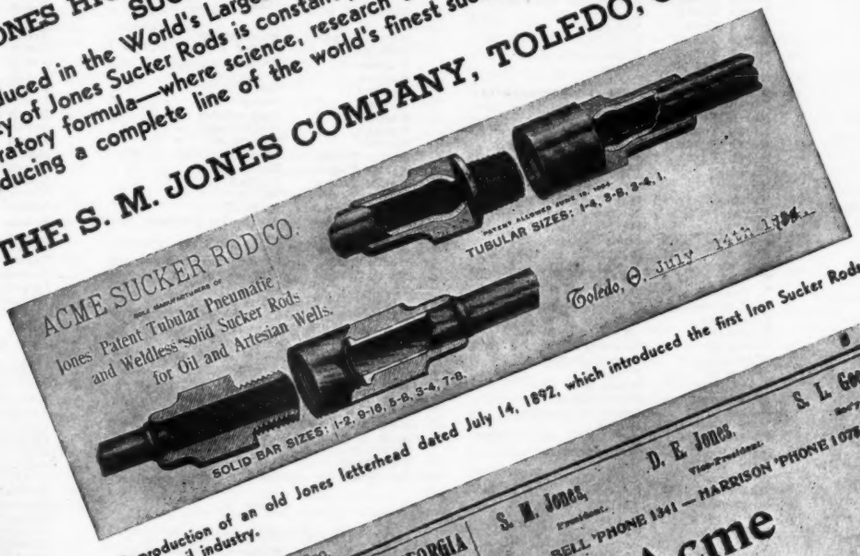
Blazing the trail of progress even in this early day, Jones—always a leader—manufactured and introduced the first iron and steel sucker rod ... acclaimed by thousands of oilmen as a vast improvement over the old wooden sucker rods which were formerly used.

Thus began the first of a long line of Jones Sucker Rod improvements, modified down through the years until we reach the celebrated—

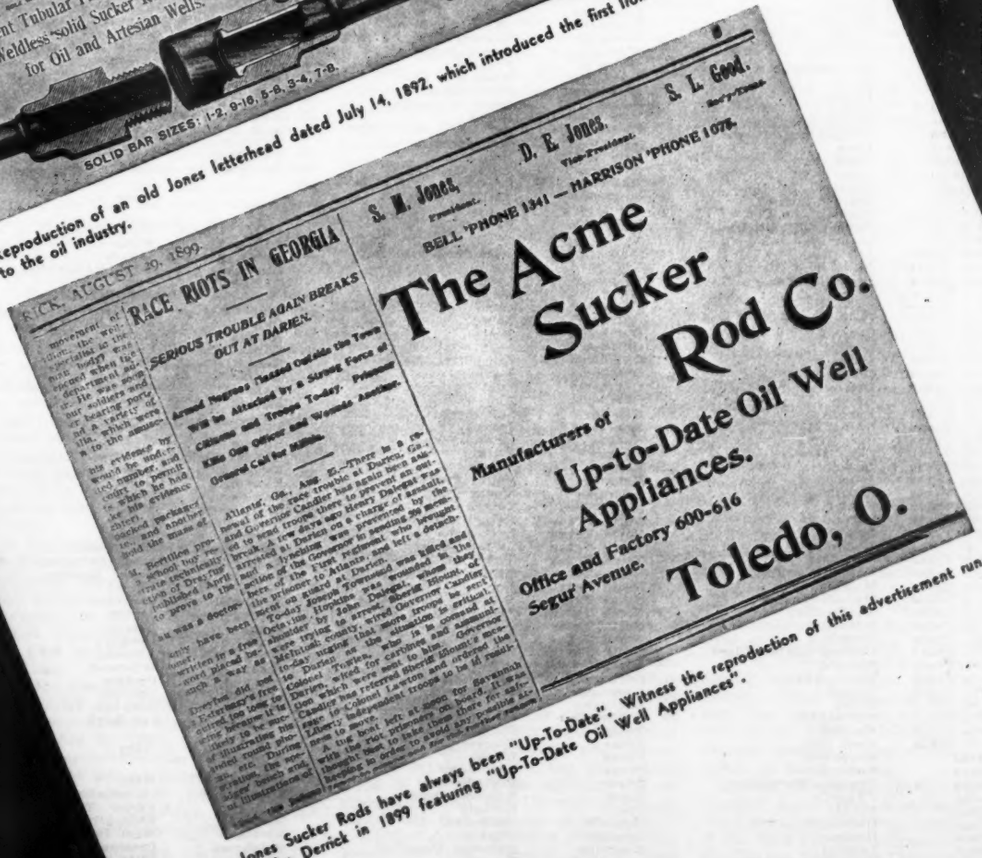
JONES HIGH MANGANESE FULL-NORMALIZED SUCKER ROD OF TODAY

—Produced in the World's Largest Sucker Rod Plant where the metallurgical quality of Jones Sucker Rods is constantly maintained with the precision of a laboratory formula—where science, research and skilled craftsmen unite in producing a complete line of the world's finest sucker rods.

THE S. M. JONES COMPANY, TOLEDO, OHIO


ACME SUCKER ROD CO.
Jones Patent Tubular Pneumatic and Weldless Solid Sucker Rods for Oil and Artesian Wells.
TUBULAR SIZES: 1-4, 3-8, 3-4, 1.
SOLID BAR SIZES: 1-2, 9-16, 5-8, 3-4, 7-8.
Toledo, O. July 14th 1892.

Reproduction of an old Jones letterhead dated July 14, 1892, which introduced the first Iron Sucker Rods to the oil industry.


RACE RIOTS IN GEORGIA
SERIOUS TROUBLE AGAIN BREAKS OUT AT DARIEN.
S. M. Jones, President. D. E. Jones, Vice-President. S. L. Good, Sec'y-Treas.
BELL 'PHONE 1341 — HARRISON 'PHONE 1078.
The Acme Sucker Rod Co.
Manufacturers of Up-to-Date Oil Well Appliances.
Office and Factory 600-616 Segur Avenue.
Toledo, O.

Jones Sucker Rods have always been "Up-To-Date". Witness the reproduction of this advertisement run in The Derrick in 1899 featuring "Up-To-Date Oil Well Appliances".

State—	Field—
North Texas	Bulcher
North Texas	Buttram
North Texas	Carolina-Tex
North Texas	Chalk
North Texas	Chittim
North Texas	Church and Fields
North Texas	Cole
North Texas	Cook
North Texas	Eades
North Texas	Flukman
North Texas	Fry
North Texas	Gholson
North Texas	Griffin
North Texas	Gwinnup
North Texas	Hendricks
North Texas	Howard-Glasscock
North Texas	Hudson
North Texas	Humble-Graham
North Texas	Jermyn
North Texas	Lueders
North Texas	(Crane County)
North Texas	McElroy
North Texas	Nigger Creek
North Texas	Noodle Creek
North Texas	Obera-Seaurd
North Texas	Parsons
North Texas	Phillips-Fry
North Texas	Ramsower
North Texas	Randado
North Texas	Sherk
North Texas	Simms
North Texas	South Bend
North Texas	Taylor
North Texas	Texas-Fidelity
North Texas	Turberville
North Texas	Wentz
North Texas	White
North Texas	Woodson
North Texas	Yates
Kansas	Austin
Kansas	Churchill
Kansas	Fankhauser
Kansas	Gorham
Kansas	McPherson
Kansas	Morrison
Kansas	Propp
Kansas	Resnicek
Kansas	Shaffer
N. Louisiana	Carterville
N. Louisiana	Richland
Arkansas	Lisbon
Arkansas	Urbana
Arkansas	Smelter
Louisiana	Lockport
Louisiana	Sweet Lake
Louisiana	Sulphur
Louisiana	Stark
Wyoming	Dutton Creek
Wyoming	Sunshine Basin
Wyoming	Ant Hills
Colorado	North McCallum
Colorado	Oak View
Colorado	Hiawatha
New Mexico	Maljamar
California	Mount Poso
California	Seal Beach
California	Alamitos
California	Goleta

1927

Kentucky	Hayden
Kentucky	Ambrose
Kentucky	King
Kentucky	Brown
Kentucky	Ruby
Kentucky	Whitesville
Oklahoma	Boyle
Oklahoma	Burder
Oklahoma	Darby
Oklahoma	Gibson and Booker
Oklahoma	Independent
Oklahoma	Lima
Oklahoma	Little River
Oklahoma	Long
Oklahoma	Manion
Oklahoma	Pearson Switch
Oklahoma	Ramsey
Oklahoma	Roxana (Marshall)
Oklahoma	Tatums
North Texas	Alberson
North Texas	Bland and Strange
North Texas	Brenecke-Moody
North Texas	Byler
North Texas	Carey Lake
North Texas	Cedar Creek
North Texas	Connell
North Texas	Cuellor
North Texas	Dale
North Texas	Danglemeyer
North Texas	Driscoll
North Texas	Emby
North Texas	Eckert
North Texas	Graham
North Texas	Greyback
North Texas	Gulf-Saunders
North Texas	Isabell
North Texas	Johnson
North Texas	Killam
North Texas	Kohler
North Texas	Larremore
North Texas	Lesehbur
North Texas	Magnolia
North Texas	McAllister
North Texas	McIlroy
North Texas	McMillan
North Texas	Milham-Casey
North Texas	Montgomery
North Texas	Muenster
North Texas	Overall
North Texas	Pandem-Buffalo-Clerk
North Texas	Sanford
North Texas	Santa Ana
North Texas	Settles
North Texas	Sibley
North Texas	Smith-Ellis
North Texas	Waddell
North Texas	West Cole
Kansas	Abbeyville
Kansas	Alexander
Kansas	Benton (Marmane)
Kansas	Edwards
Kansas	Eureka
Kansas	Haverhill
Kansas	Hittle
Kansas	Lament
Kansas	Latta
Kansas	Lost Springs
Kansas	North Gorham
Kansas	Oxford
Kansas	Quincy
Kansas	Rocks
N. Louisiana	Benson
N. Louisiana	Pleasant Hill
N. Louisiana	Sikes
Arkansas	Champagnolle
Texas	Allen
Texas	Sugarland
Louisiana	Hackberry
Louisiana	East Hackberry
Louisiana	Starks
Louisiana	Sorrento
Wyoming	Ant Hills
Wyoming	Garland
Wyoming	Cozy Structure
Wyoming	Spindletop
Montana	Bannatyne
Montana	Pondera
Colorado	Berthoud
New Mexico	Getty
New Mexico	Hospah
New Mexico	Texas (Rhodes)
California	Alamitos Heights
California	Buttonwillow
California	Potrero
California	Rincon (Sea Cliff)
California	Round Mountain
California	Sulphur Mountain

1928

Kentucky	Brown
S. W. Indiana	Shiloh
S. W. Indiana	Rockport
Oklahoma	Booch Sand Pool
Oklahoma	Garrett
Oklahoma	Little Seminole
Oklahoma	Oklahoma City Field
North Texas	Armstrong-Boyd
North Texas	Bickley
North Texas	Buchanan
North Texas	Chapman
North Texas	Consolidated
North Texas	Darst Creek
North Texas	Driscoll
North Texas	Goblke (Goblke)
North Texas	Jennings
North Texas	Joe Bruner
North Texas	Kingwood McCord
North Texas	Leck
North Texas	Lefors
North Texas	Mathews
North Texas	McLarty
North Texas	Morse
North Texas	Ottine
North Texas	Panhandle-Daugherty
North Texas	Royson
North Texas	Shipley
North Texas	Skelly
North Texas	Sun-Cranfill
North Texas	Tiner
Kansas	Ellis
Kansas	Goodrich
Kansas	Harvey County
Kansas	Moline Townsite
Kansas	Rush County
Kansas	Sluss
Kansas	Wright
Arkansas	Mount Holly
N. Louisiana	Epps
N. Louisiana	Holly
N. Louisiana	White Sulphur Springs
Louisiana	Sorrento
Louisiana	Bayou Bouillon
Louisiana	Loreauville
Wyoming	Alkali Butte
Wyoming	Frannie
Wyoming	Muskrat
Wyoming	Four Bear
Colorado	South McCallum
New Mexico	Hobbs
New Mexico	Jal
New Mexico	Stoney Butte
New Mexico	Mancos
New Mexico	Texas-Lynch
Montana	Border
California	Kettleman Hills
California	Lawndale
California	Elwood

1929

Michigan	Leaton
Michigan	Vernon
Illinois	Dupo
Oklahoma	Asher
Oklahoma	Beebe
Oklahoma	East Seminole
Oklahoma	Carr City
Oklahoma	Sasakwa
Oklahoma	East Earlsboro
Oklahoma	Konawa
Kansas	Chindberg
Kansas	Cross
Kansas	Eastborough
Kansas	Kuski
Kansas	Shutts
Kansas	Valley Center
Arkansas	Mount Holly
North Texas	Yost
North Texas	Eckert
North Texas	Larremore
North Texas	Lytton Springs
North Texas	Salt Flat
North Texas	Ottine
North Texas	Van
North Texas	Eastland Pool
North Texas	Fisher County
North Texas	Government Wells
North Texas	Cow Hill
North Texas	Pecos Valley
North Texas	Pryor
North Texas	Taylor-Link
Louisiana	Dog Lake
Louisiana	Port Barre
Louisiana	White Castle
Texas	Clay Creek
Texas	Esperson
Texas	Hankamer
Texas	Lost Lake
Texas	Port Neches
Texas	Raccoon Bend
Texas	Refugio
Colorado	Hiawatha
Colorado	Walden
Wyoming	Mahoney Dome
New Mexico	Hospah
New Mexico	Cap Rock
California	Playa Del Rey
California	Tulare Lake
California	Huasana
California	Capitan
California	Santa Barbara
California	Moore Ranch

1930

West Virginia	Bozo
Michigan	Leaton
Michigan	Vernon
Oklahoma	South Earlsboro
Oklahoma	Wanette
Oklahoma	Wewoka Townsite
Kansas	Beyer
Kansas	Cunningham
Kansas	Davidson
Kansas	Dillner
Kansas	Gideon
Kansas	Haury
Kansas	Heiken
Kansas	McCarty
Kansas	Ochs
Kansas	Raymond
Kansas	Rega
Kansas	Ritz-Canton
Kansas	Sellens
Kansas	Voshell
Kansas	Wellington
North Texas	Cooksey
North Texas	Manford
North Texas	Chacon Lake
North Texas	East Texas
North Texas	Kissinger
North Texas	Martinez
North Texas	Roma
North Texas	Escobas
North Texas	Irion
Louisiana	Caillou Island
Texas	Agua Dulce
Texas	Moss Bluff
Texas	Mykawa
Texas	Pettus
Texas	Saxet
Texas	Slick
Texas	White Point
Mississippi	Jackson
Colorado	Berthoud

1931

West Virginia	Huntington
Michigan	Porter
Kansas	Burrton
Kansas	Greenwalt
Kansas	Isern
Kansas	Ploog
Kansas	Richardson
Kansas	Stoltenberg
Kansas	Stratmann
North Texas	Shimmel-Batts
North Texas	Branyon
North Texas	Dunlap
North Texas	Marlin
North Texas	S. R. C.
North Texas	South Government Wells
North Texas	Los Olmos
North Texas	Penn
North Texas	Deeprock-Fuhrman
North Texas	Cowden
Texas	Lucas
Texas	Manvel
Texas	Thompsons
Louisiana	Cameron Meadows
Louisiana	Choctaw
Louisiana	Lake Washington
Louisiana	Leeville
Louisiana	Iowa
Colorado	Greasewood
New Mexico	Cooper
New Mexico	Lea
California	Kettleman Middle Dome
California	San Miguelito
California	Gato Ridge

1932

West Virginia	Huntington
Michigan	Porter
Oklahoma	Lucien
Oklahoma	West Holdenville
Oklahoma	Fish
Oklahoma	Conservation
Oklahoma	County Line
Oklahoma	South Burbank
Kansas	Mabee
Kansas	Chase Townsite
Kansas	Stratman
Kansas	Johnson
Kansas	Winfield Townsite
Kansas	Steckel
Kansas	Breford
Kansas	Ellinwood
Kansas	Hollow
Kansas	Miller
Kansas	Nikkel
Kansas	Orth
Kansas	Sharpe
North Texas	Marlin
North Texas	Jacob
North Texas	Sarnosa
North Texas	Rio Grande City
North Texas	North Government Wells
Arkansas	Miller County
North Texas	Laurel
N. Louisiana	Converse
Texas	Arriola
Texas	Conroe
Texas	Buckeye
Texas	Keeran
Texas	O'Connor
Texas	Pledger
Louisiana	Darrow
Louisiana	Gueydan
Montana	Cut Bank

1933

Michigan	Hart
Michigan	(Montcalm County)
Michigan	Porter Township
Michigan	Rosebush
Michigan	West Branch Township
Oklahoma	Crescent
Oklahoma	Fitts
Oklahoma	Keokuk Falls
Oklahoma	Olive
Oklahoma	Sasakwa Townsite
Oklahoma	West Chandler
Kansas	Brandenstein
Kansas	Chase
Kansas	Gates
Kansas	McCann
Kansas	Thode
East Texas	Long Lake
North Texas	(Foard County)
West Texas	Addis
West Texas	Boren
West Texas	Cowden Ranch
West Texas	Hawley
West Texas	Masterson
West Texas	Mertzon
West Texas	Ogden
S. W. Texas	Byersville
S. W. Texas	Cuevitas
S. W. Texas	Eagle Hill
S. W. Texas	Hilbig
S. W. Texas	Ignacio
S. W. Texas	Moca
S. W. Texas	North Kohler
S. W. Texas	Stewart
S. W. Texas	Von Ormy
Texas	Cleveland
Texas	Colette
Texas	Greta
Texas	Livingston
Texas	Louise
Texas	Premont
Texas	Tomball
California	Mountain View

1934

Oklahoma	Newalla
Oklahoma	Binger
Oklahoma	Meeker
Oklahoma	Wilzetta
Oklahoma	Langston
Oklahoma	Polo
Oklahoma	(Logan County)
Oklahoma	Sec. 2-5-7
Oklahoma	Sec. 18-10-6
Kansas	Twp. 12-13w
Kansas	Graber
Kansas	Gennessee
Kansas	Hilger
North Texas	Cayuga
North Texas	Long Lake
North Texas	Woods
North Texas	Todd
North Texas	Courtney
North Texas	North Brayson
North Texas	Ward Ranch
North Texas	(Coleman County)
North Texas	(Brown County)
North Texas	Mary Bowden
North Texas	Angelita
North Texas	Sinton
North Texas	Caesar
North Texas	Jeffries Lambeth
North Texas	Bruni
North Texas	Eagle Hill
Texas	Van Vleck
Texas	Splendora
Texas	Rye
Texas	Vanderbilt
Louisiana	Bosco
Louisiana	Lake Hermitage
Louisiana	Roanoke

MISCELLANEOUS FIELDS

Definite date not known.

Kentucky	Armstrong Mills
Kentucky	Ashland
Kentucky	Brink Hover
Kentucky	Brooklyn
Kentucky	Brushy Creek
Kentucky	Butler
Kentucky	Cambridge
Kentucky	East Liverpool
Kentucky	Elyria
Kentucky	Flushing
Kentucky	Grafton
Kentucky	Griffith
Kentucky	Harper
Kentucky	Homer
Kentucky	Hopewell
Kentucky	Kilbuck
Kentucky	Kilgore
Kentucky	Malaga
Kentucky	McIntyre
Kentucky	Medina
Kentucky	Mingo
Kentucky	Nashport
Kentucky	New Waterford
Kentucky	Ostego
Kentucky	Pleasantville
Kentucky	Rockport
Kentucky	Scott
Kentucky	Stark County
Kentucky	Starr
Kentucky	Stumptown
Kentucky	Sugar Grove
Kentucky	Willerbrook
Kentucky	Beallsville
Kentucky	Black
Kentucky	Bosworth
Kentucky	Bremen Junction City
Kentucky	Burkhart
Kentucky	Chaseville
Kentucky	Cooker
Kentucky	Decker
Kentucky	Denbrow
Kentucky	Egger
Kentucky	Fifteen
Kentucky	Fisher
Kentucky	Gallipollo
Kentucky	Glouster
Kentucky	Heffman
Kentucky	Lewisville
Kentucky	Locust Grove
Kentucky	Marietta
Kentucky	McArthur
Kentucky	McConnelsville
Kentucky	Monroefield
Kentucky	Moore
Kentucky	Mount Perry
Kentucky	Porterfield
Kentucky	Rinard's Mills
Kentucky	Salt Run
Kentucky	Schriver
Kentucky	Summerfield
Kentucky	Wahl
Kentucky	White Cottage

HOLLIDAY . . HANLON . . KANE . . HENDEE . . McCLINTOCK . . PHILLIPS . . LEGH-JONES . . BELITHER . . TROWER . . van der WOUDE . . SMITH
SANDS . . DAVISON . . ANDERSON . . LEOVY . . ROLLIN . . TOWL . . EASTELL . . YOUNG . . GREIS . . DOW . . BASCOM . . SUTRO . . CRAWFORD
GETTY . . KECK . . SCHAUER . . TUTTLE . . KINGSBURY . . CURRY . . FRASER . . FARQUHAR . . KNAPPEN . . WINSHIP . . MESSNER . . DINES

PERSONALITIES

W. T. Holliday, president of the Standard Oil Co. of Ohio, was appointed general counsel of that company in 1917 and became president in 1928.

E. I. Hanlon, chairman of the boards of Hanlon-Buchanan, Inc., and of the National Bank of Tulsa, entered the oil business as bookkeeper for Henaghan & Daly, operators in Sistersville, W. Va.

R. W. Hendee, president of the Oklahoma Natural Gas Co., entered the employ of that company 13 years ago as a gas tester and meter man.

Alexander Fraser, president of Shell Petroleum Corp., began his oil career with the Pumpherston Oil Co. of Scotland.

R. Otis McClintock, president of the First National Bank & Trust Co. of Tulsa, began his oil experience in the warehouse of the Gypsy Oil Co., in the Glenn Pool in Oklahoma about 1907. He rose to be vice president of that company.

W. M. Keck, president of the Superior Oil Co., started in the oil business as a general utility man in the Coalinga Field and a little later he was pushing tools for the Kern Trading & Oil Co. in the same field.

George Legh-Jones, for the past 10 years president of the Shell Oil Co. of California, but who recently was transferred to London, England, where, it is understood, he will be assistant to Sir Henri Deterding in general charge of North and South American operations, went to California from the Royal Dutch-Shell headquarters in London. Sidney Belither has been advanced from vice president to president of the Shell Oil Co. of California.

Frank Phillips, president of the Phillips Petroleum Co., one of four brothers. Frank, L. E., John and Waite, who have made history in the fifth period of the oil industry, was, like his brothers, an Iowa farm-bred boy. He came to Oklahoma in 1903, three of the brothers having pooled their funds, and started operating in the Bartlesville district with success.

The career of L. E. Phillips, vice president of the Phillips Petroleum Co., parallels that of his elder brother, Frank, as they have been associated in all their operations in the Mid-Continent Field.

Waite Phillips carved out a career of his own. First in the retail sales end, then as a big producer in the Okmulgee fields, next as head of the Waite Phillips Co., which company he sold, and lastly at the head of the Independent Oil & Gas Co., which was merged with the Phillips Petroleum Co.

R. G. A. van der Woude, president of Shell Union Oil Corp., has been associated with the Shell Group for the past 25 years. The early period of his oil career was spent in Shanghai, China, where he was general manager of the Asiatic Petroleum Co. for North and Central China.

T. K. Smith, one of the organizers of the Chestnut & Smith Corp., and head of the Smith Separator Co., came to Oklahoma from West Virginia and was attracted by the future possibilities of the natural gasoline business.

Allan T. Towl, president of the Southern Group of Pipe Lines, first gained pipe line experience with western lines. After serving as vice president of the Oklahoma Pipe Line Co. he moved to New York to become vice president of the Southern Group of Pipe Lines and then president.

Paul Getty, president of George F. Getty Oil Corp., followed his father in the oil business, the latter having been a widely known and successful producer. The son when a young chap undertook to drill a well in California to prove that he was a real oil man, and he made good.

G. S. Rollin, vice president in charge of the Mid-Continent production area, Shell Petroleum Corp., began his career in 1918 as a geologist at Tulsa, subsequently becoming chief exploitation geologist and later field superintendent.

John H. Kane, vice president of the Phillips Petroleum Co., was a prominent lawyer when he joined the Phillips organization as counsel.

Richard T. Eastell is president of the Washington Oil Co. and director of the Pennsylvania Grade Crude Oil Assn.

R. M. Young, president of the Carter Oil Co., retired, started as an office boy for the old Forest Oil Co. in Pittsburgh, but he had a head for figures and was advanced to accounting and auditing. He assisted in the organization of the Prairie Oil & Gas Co. which had been the western division of the Forest Oil Co.

R. P. Bascom, general vice president of Shell Petroleum Corp., entered the service of the company in 1918 as manager of Yachola Pipe Line, which later became Shell Pipe Line Corp.

H. N. Greis, president of the Burke-Greis Oil Co., Tulsa, was educated in West Point Military Academy and soon afterward entered the oil and gas business by working for the West Virginia & Maryland Gas Co. in the West Virginia Field. He came to Oklahoma in 1907 and successfully operated in numerous fields.

Harry Moreland, vice president and general manager of the Great Lakes Pipe Line Co., started in the business as a clerk in the pipe line department of the Marland Oil Co. in 1920.

J. H. Tuttle, secretary and comptroller and a member of the board of Standard Oil Co. of California, joined the company in 1903 in the San Francisco offices. In 1918 he became assistant general auditor.

F. A. Leovy, vice chairman of the board of the Gulf Oil Corp., was placed in charge of the company's production in the Beaumont, Tex., area in 1905. He was later named vice president in charge of all production at Houston.

F. R. Phillips, president of the Philadelphia Co., became associated with the oil and gas industry through the public utility business. In 1928 he was named vice president of the Philadelphia Oil Co. and in 1929 president. In 1931 Mr. Phillips was elected to his present position.

Oscar Sutro, vice president and chief counsel of the Standard Oil Co. of California, came into the oil business through the law. He was elected to the board of directors of the Standard Oil Co. of California in 1926 and made vice president in 1929.

H. H. Anderson has been general vice president of Shell Petroleum Corp., St. Louis, Mo., since September, 1933. Prior to his transfer to St. Louis, he had been associated for 15 years in various capacities with Shell Union Oil Corp. in New York and Shell Oil Co. on the Pacific Coast.

K. R. Kingsbury, president of the Standard Oil Co. of California, dates his first connection with the oil business back to December 27, 1897, when he started on pipe line construction work in Pennsylvania. He was oil gauger at the Millway, Pa., station two years and then went into 26 Broadway, joining the Standard of California in 1906.

George W. Crawford, chairman of the board of the Columbia Gas & Electric Corp., was born in and to the oil and gas business. At an early age he roustabouted on his father's leases. While yet a young man he joined E. M. Treat. They began building companies which have developed into a utility empire.

Fred Crawford, deceased, also worked on leases as a boy near Emlenton, Pa. He cast his fortunes with his brother, George, and was an officer and director in the Columbia Gas & Electric Corp. at the time of his death.

Harry J. Crawford, producer, refiner and banker, was another who got his first experience at hard work on Emlenton leases. He is a director and officer in the Columbia Gas & Electric Corp.

J. M. Sands, vice president of the Phillips Petroleum Co., had his first oil experience as a geologist for the Southern Pacific Railroad in the oil fields of California, Texas and Mexico.

Peter H. Curry, president of the South Penn Oil Co., began with the National Transit Co. in 1890 at Oil City. He joined the South Penn Oil Co. and became vice president in charge of development work and repressuring operations in the Bradford Field. He succeeded the late Lemuel Watson Young as president.

H. A. Trower, vice president of the Phillips Petroleum Co., came into the oil business from the Santa Fe Railroad, becoming traffic and sales manager of the Phillips company.

George S. Davison, who retired as vice president of the Gulf Oil Corp. in 1929, was early associated with the Mellon interests in various projects.

J. G. Farquhar, president of the Big Lake Oil Co., took over the duties of vice president and treasurer of that company in Reagan County, Texas, in 1923. His offices now are in Pittsburgh.

Daniel O. Towl started work with the Standard Oil Co. of New Jersey and followed pipe line work. After serving as president of the Tuscarora Pipe Line Co. he resigned to become vice president of the Andian National Corp., a subsidiary of the Imperial Oil Co., Ltd., of Canada. Mr. Towl is now with the Imperial Oil Co. of Canada.

Kendall Winship, who was vice president of the Gypsy Oil Co. at the time of his death in 1933, came to Oklahoma in 1910 with the National Supply Co. He became production foreman of the Comar Oil Co. when the Burbank Pool was opened and joined the Gulf in 1924, serving considerable time in South America.

L. D. Messner, treasurer of the Barnsdall Corp. and the Barnsdall Oil Co., entered the business in 1910 as cashier of the Osage and Oklahoma Co., forerunner of the Oklahoma Natural Gas Corp.

J. J. Conry, vice president of the Carter Oil Co., came into the oil business in the Ohio fields. He was sent to Rumania by the Standard Oil Co. of New Jersey and remained there until the oil fields were overrun by the Germans. Returning to the United States he joined the Carter Oil Co. and soon after was made general superintendent.

T. A. Dines, president of Utah Oil Refining Co. and of the Salt Creek Producers and president of Midwest Refining Co. at the time of the dissolution of that company in 1932, was identified with the financial interests which started the development of the Salt Creek Field. A year after the Midwest was organized, in 1915, Mr. Dines became associated with that company as treasurer.

Richard Airey, president of the Asiatic Petroleum Corp., entered the oil business in 1890 in the sales and distribution department of the Anglo-American Oil Co. in Liverpool, England.

Walter B. Sharp, outstanding early Gulf Coast operator and one of the founders of the Texas Co., just missed opening the Spindletop Pool eight years in advance. In 1893 his drilling outfit was defective and the hole was bottomed about 200 feet above the pay.

James J. McGraw, who was president of the McGraw Oil Co. and for years head of the Exchange National Bank of Tulsa, was a pioneer operator in the Kay County fields in Oklahoma.

George H. Lang, vice president of the Carter Oil Co., broke into oil as a Carter scout. He was made chief scout and later assistant to the president and then raised to his present position.

Theodore C. Towl started work in the field for the Standard Oil gas companies in West Virginia. Mr. Towl resumed work with the Southern Group of Pipe Lines on his return from service in the World War and at present is vice president and general manager of the South West Pennsylvania Pipe Lines and also of the Southern Pipe Line Co.

R. S. Knappen, assistant to the vice president of the Gypsy Oil Co., was the first man to climb Veniaminoff Mountain, an isolated peak on a peninsula in Alaska. He did it while with the fuel section of the U. S. Geological Survey which he had joined in 1920. He became connected with the Gulf interests in 1926.

F. F. Schauer started with the United Gas Improvement Co. in Philadelphia in 1899. In 1929 Mr. Schauer was appointed vice president of the Equitable Gas Co.

Wilbur T. Funk, retired, vice president of the Carter Oil Co., was the son of the man who completed the first flowing well, but vicarious honors did not satisfy him and he carved his own way up through official positions in the Standard Oil Co.

Henry McGraw, vice president and general manager of the Gypsy Oil Co. and the Gulf Pipe Line Co. of Oklahoma at the time of his death, entered the oil business through the law. He left a fine law practice to go with the Gypsy and Gulf in the land department.

Murray M. Doan, now a Tulsa banker, was for years head of the Gypsy Oil Co. and Gulf Pipe Line Co. of Oklahoma. The company's famous Boston lease, Jackson Barnett lease and Shumway lease, three of the most notable oil properties in the Mid-Continent, were acquired and developed during his regime.

W. C. McBride was a leading oil man in the third and fourth periods of the oil business. In 1914 he was the largest individual oil producer in the world.

H. T. Klein, vice president and chief counsel for the Texas Co., was a soldier in France when he met Edwin B. Parker, the Texas Co.'s chief counsel, who made him assistant chief counsel.

Edward T. Moore, president of the Simms Oil Co., Dallas, Texas, since 1920, was president of the Anchor Oil Co. in 1919 during the Ranger, Texas, boom.

B. S. SoRelle, manager, Texas producing division, Pure Oil Co., Fort Worth, Texas, graduated as a lawyer and then went to work for Gulf Production Co. in 1910 as assistant in charge of land, geological and scouting departments in South Texas.

Glenver McConnell, head of the mechanical engineering departments of the Mid-Continent and Gulf Coast divisions of the Shell Petroleum Corp., started with the Roxana Petroleum Corp. in 1923.

Erle P. Halliburton, president of the Halliburton Oil Well Cementing Co., was born into what had been a prosperous

Absolute Control at the Head of the Well

ORIGINAL TYPE "A" CONTROL CASING HEAD

— 1914 to 1934 —

In 1914 the original Type "A" Control Casing Head revolutionized oil well drilling. It was the first casing head arrangement to: Permit all drilling operations without requiring any extra attention or otherwise interfering with the work—Control any flow instantly without putting back pressure on the well—Make the controlling of any well a perfectly safe operation—Have strength to control highest pressures—Be simple in construction, compact in size, unaffected by sand, rough handling, etc., and—Offer resistance to fire.

For twenty years The Oil Well Improvements Company has kept pace with changing conditions with provision for absolute control at the head of the well. Now—in 1934—has been developed The O. W. I. Co. complete Control Tree.

The O. W. I. Co. Complete Control Tree

—*Including the New HEGGEM Valves*

This assembled hook-up consists of a Type "CH" Heggem Valve, O.W.I. Tubing Control Box, and the disc type Heggem Flow Line Valves. The Type "CH" Heggem Valve is a quick-opening and closing valve that assures positive sealing at all times. The spider in the base of this valve provides a means for hanging the tubing and also provides a seat for the mandrel in the Tubing Control Box. The Tubing Control Box has side outlets for both casing and tubing flow, as well as a top outlet that can be used for cleaning out tubing. The mandrel in the control box may be raised, permitting the type "CH" Valve to be closed, shutting in the well below all fittings. All fittings used on the O.W.I. Control Tree are heavy cast steel with no welded joints. This hook-up is provided for test pressures from 2,000 to 6,000 pounds. It is completely assembled and tested before shipping.

THE O. W. I. CO. CONTROL TREE

THE OIL WELL IMPROVEMENTS CO.

TULSA, OKLAHOMA

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

AIREY . . SHARP . . LANG . . CONRY . . FUNK . . McGRAW . . DOAN . . McBRIDE . . KLEIN . . MOORE . . CLARK . . HALLIBURTON . . CAVANAUGH
SoRELLE . . VANDEVENTER . . O'SHAUGHNESSY . . LEE . . NOBLE . . KINCADE . . YOUNT . . NEATH . . WARNER . . KULDELL . . HASSON . . SUHR
MESSER . . ZOOK . . RAMAGE . . BRUNDRED . . ROESER . . PENDLETON . . DENNING . . LEONARD . . WALLACE . . RATCLIFFE . . BAY . . TREES

land-owning family of the old South, but the Civil War changed all that, so as soon as Erle had graduated from high school he went to work as an office boy in a railroad office at $16 a month.

D. J. Cavanaugh, secretary of the Pennzoil Co., went to work for the Valley Oil Co. at Rouseville, Pa., in 1892 and remained with that company and its successors ever since.

M. Frank Yount, deceased, president of Yount-Lee Oil Co., of Beaumont, Tex., started working as a roustabout during the Spindletop boom in 1901. He went to the Gulf Coast from his home in Monticello, Ark., to work in rice fields and was attracted to the oil business during the excitement following the Lucas gusher.

Sheldon Clark, vice president of the Sinclair Refining Co., joined the company in 1915, shortly after it was organized. He represented the company abroad before he was placed in charge of the company's affairs in Chicago.

George L. Noble, vice president of the the Texas Co., Houston, Texas, worked for railroads before he entered the oil business, selling fuel to railroads in 1908.

In 1892 Charles L. Suhr, president of Pennzoil Co. and vice president of British American Oil Co., entered the refining business as a stenographer in his father's plant in Oil City, Pa., the Penn Refining Co. Two years later he began a series of plant jobs which was to take him through every department of the business.

J. C. Trees, of Benedum & Trees, was a tool dresser in Indiana County, Pennsylvania, and later made oil connections in Pittsburgh while attending Western University of Pennsylvania, which aided in his success.

I. A. O'Shaughnessy was in southwestern banking activities when the World War started and to help meet the demand for oil he built a 1,000-bbl. refinery in Blackwell, Okla., and started the Globe Oil & Refining Co., which now has three Mid-Continent plants.

J. A. Neath, vice president and general superintendent, Humble Pipe Line Co., Houston, Tex., served on a Gulf Pipe Line Co. pipe line gang at Saratoga, Tex., in 1912.

T. P. Lee, member of the board of directors. Yount-Lee Oil Co., Beaumont, Texas, started in 1887 as a boy of 16 in oil fields near his home town, Petroleum. W. Va. He moved to the Gulf Coast of Texas in 1903 and in 1913 joined the late M. Frank Yount in forming the company bearing their names.

E. C. Kincade, vice president of the Gulf Pipe Line Co., Houston, has always been a pipe liner working for the Gulf interests since September, 1907, when he joined the organization at Lufkin, Texas, as an engineer.

C. E. Crawley, vice president of the Consolidated Oil Corp., was connected with the Gulf organization in Tulsa around 1909 and became assistant to Murray Doan, head of the Gulf interests in Tulsa. When the Sinclair Oil and Gas Co. was formed in 1916, Mr. Crawley went with that company.

In 1897 Sam Messer, president of Quaker State Oil Refining Co. and vice president of Quaker State Refining Corp. and James H. Berry Sons' Co., entered the industry as bookkeeper at the Emlenton (Pa.) Refining Co. plant, becoming treasurer of the company nine years later.

M. L. Benedum of the Transcontinental and other companies, started in the oil business in the lease department of the South Penn Oil Co.

Charles F. Roeser, president of Roeser-Pendleton, Inc., Fort Worth, and vice chairman of the Planning and Coordination Committee of the petroleum code, worked for his brother Bill on an oil lease in Oklahoma soon after he graduated from Marietta College, Ohio.

T. T. Pendleton, Roeser-Pendleton, Inc., was an all-American football player at Princeton University and a five-letter man in athletics. He started in the oil business as roughneck in the Gulf Coast fields in 1915.

L. B. Denning, president Lone Star Gas Co., Dallas, Tex., was an attorney for natural gas company interests in southern Ohio in 1902 and general counsel of the Ohio Fuel Supply Co. in 1910.

Edward H. Chandler, general counsel of the Sinclair Prairie Oil Co. and the Sinclair Prairie Pipe Line Co., entered the business with H. F. Sinclair in the good old days at Independence, Kans.

F. B. Parriott, president of the Transcontinental Oil Co., began as a roustabout in the West Virginia fields in 1900.

Charles A. Warner, superintendent of land department, Houston Oil Co., Houston, Tex., was field geologist for Empire Gas & Fuel Co. stationed in Osage County, Oklahoma, in 1917 and went to work for Houston Oil Co. as district manager in Oklahoma in 1931.

Archie W. Leonard, vice president and general manager of the Devonian Oil Co., was born on an oil lease at Turkey City, Pa., was an oil field pumper at the age of 14 and built the first natural gas trunk pipe line in Oklahoma in 1905.

Dr. Gustav Egloff, internationally known authority on thermal decomposition and director of research for the Universal Oil Products Co., joined the Bureau of Mines after completing oil research work at Cornell and Columbia Universities.

William H. Hasson of Oil City, Pa., nine days after the Drake well came in, started in the oil business, but his first success did not come until 1863 when he drilled the Maggie well on Shaffer Run hill in Venango County. He organized the First National Bank of Oil City, one of the oldest banks in the eastern oil country.

R. J. Berry, deceased, who was president of the Mid-Kansas Oil & Gas Co. and vice president of the Ohio Oil Co., started as secretary to the late J. C. Donnell, president of the Ohio Oil Co. in 1892.

Harry A. Wallace, president of the United Fuel Co., started as a roustabout in the oil fields in West Virginia.

E. H. Salrin, vice president of Tide Water Oil Co., came to the Tide Water organization in June, 1914, as a bookkeeper for the Oklahoma Oil Co. He became secretary and treasurer of the Tidal Oil Co. and then president, which position he held when the Tidal was included in the Tide Water's consolidation.

A. Jacobsen, president of Amerada Petroleum Corp., was with the Mexican Eagle Oil Co. in Mexico, rising in that company to be general manager. He resigned and came to the states to become vice president of the Amerada in 1925.

J. C. Hilton, president of the Standard Oil Co. of Louisiana, is an old navy man, later being connected with the oil administration during the war.

E. W. Sinclair, chairman of the finance committee of the Consolidated Oil Corp., entered the oil business at Independence, Kans., with his brother, H. F., in 1903 and has been identified with the various Sinclair interests since.

George W. Ratclifte, president of the Pittsburgh group companies of the Columbia Gas & Electric Corp., rose from the ranks in the Manufacturers Light & Heat Co., finally becoming president of that subsidiary of the Columbia.

Allmand M. Blow, vice president of the Amerada Petroleum Corp., began his Mid-Continent experience as a plant chemist for Cosden & Co. About 1920 he went over to the Amerada in the company's land department.

Dr. R. E. Wilson, vice president and head of the development and patent department of the Standard Oil Co. (Indiana), was introduced to refining problems as professor of chemical engineering at the Massachusetts Institute of Technology in 1920 to 1922. In the latter year he entered the research department of the Indiana company.

E. H. Leroux, president of the Oklahoma Pipe Line Co. and vice president and general manager of the Ajax Pipe Line Co., started as a telegraph operator with the Prairie Oil & Gas Co. in 1905.

In 1878 S. Y. Ramage entered the industry with his Mutual Oil Co. refinery at Reno, Pa., which he disposed of in 1895 to devote his energies to the production branch, and to acquirement of interests in utilities, beginning with Manufacturers Light & Heat Co. and continuing to a directorship in Columbia Gas & Electric Corp.

Barton Myers, director in charge of production of Imperial Oil, Ltd., started in Clarion County, Pennsylvania, where he had charge of a producing property.

Burt R. Bay, big boss of the Panhandle Eastern Pipe Line Co., got much of his training with the Empire companies at Bartlesville, Okla.

A. E. Watts, vice president of the Consolidated Oil Corp., started with the Oil Well Supply Co at Chanute, Kans., around 1903. He was made umpire of the Cushing Field during the big production there, returning to the Oil Well and then going with the Sinclair Oil and Gas Co. when that concern was organized in 1916.

J. F. Vandeventer, first vice president of the Pennzoil Co., started in the pipe line department of the Prairie Oil & Gas Co. in 1904. While learning all about field work he must have had other ambitions, because from 1906 to 1917 we find him assistant treasurer and a director of the Barnsdall Oil Co., then with the Carter Oil Co. until he joined Pennzoil.

Walter G. Swaney, general manager, Kerotest Manufacturing Co., Pittsburgh, was one of the first two men ever to hold a blow torch.

H. R. Hughes of Houston, Tex., was a Gulf Coast operator of wide experience before his inventions of hard formation drilling tools placed him prominently in the field of manufacturing.

H. S. Austin, president of the Ajax Pipe Line Co. and in charge of construction of the pipe line of the Iraq Petroleum Co., Ltd., entered the business as a civil engineer for the National Transit Co.

T. O. Grisell, sales manager-select of the Kendall Refining Co., and aggressive secretary of the Pennsylvania Grade Crude Oil Assocation for the past two years, helped to lay the "Bartlesville 6-inch" for the Prairie Pipe Line Co. in Oklahoma in 1904.

R. R. Irwin, president of the White Eagle Oil and Refining Co., joined the Chanute Refining Co. of Chanute, Kan., in 1910, after having spent a short period in the fields of Southeastern Kansas.

Daniel T. Pierce, assistant to the chairman of the executive committee of the Consolidated Oil Corp., was an expert in the Public Relations line before going with the Sinclair interests about six years ago.

Daniel M. Sachs, president of the National Transit Co. and its subsidiaries, made his first pipe line connection when he became associated with the Northern Pipe Line Co. in 1911.

General Baird H. Markham, who so successfully organized and has since directed the American Petroleum Industries Committee, was treasurer of the Marland Oil Co.

William M. Irish, president of the Atlantic Refining Co., comes from a family of refiners who date back to the first days of oil.

In 1904 W. J. Brundred, large producer in the middle Pennsylvania district and in Kansas, began developing his own properties in Cornplanter Township, Venango County, Pennsylvania, and extended his activities to the Nowata (Oklahoma) pool two years later. In 1914 he was authorized to issue licenses on air repressuring for secondary recovery.

S. M. Jones, operator, inventor and manufacturer, was popularly known to the entire oil industry as "Golden Rule" Jones because that rule was the only one posted in his shop. His first experiences were in the Pennsylvania fields as early as 1865. He was the first president of the Ohio Oil Co. and the Northern Indiana Oil Co. and in his later years served as mayor of Toledo.

W. J. Judge, president of the National Gas Co., got his early training under Wade Hampton in helping audit the different pipe line companies in the early days.

Howard Bennette, national co-ordinator under the petroleum code, was city attorney of Conroe, Tex., in 1909, before he was 21 years old and long before oil was found at Conroe.

E. O. Bennett, chief engineer of the Continental Oil Co., is a native son, starting up the ladder in the California oil fields.

George H. Taber, Jr., vice president of the Sinclair Refining Co., really was born in the refining business. His father had charge of the Atlantic refinery near Franklin, Pa., and George Jr. was born "in the refinery yard." He went with the Sinclair interests in 1917.

J. C. Van Eck, who last fall became chairman of the executive committee of the Shell Union Oil Corp., has been with the Shell organization in this country for upwards of 20 years.

Alvin Richards, chief counsel for the Pure Oil Co., in its southwestern division, entered the oil business through legal channels in 1919.

James D. Berry and Charles D. Berry of James B. Berry Sons Co. have been refiners and marketers of Pennsylvania products for over 40 years.

R. M. Moody, vice president of the National Bank of Tulsa, was born in Titusville, and came to Tulsa in 1913. It is said his father, a doctor in Titusville, brought half the oil men of the world into the world.

Harold M. Balch, of the Sinclair Prairie Oil Co., started with that concern in August, 1917, after he had finished school in St. Louis.

D. S. Bushnell, president of the Northern Group Pipe Lines, including the Indiana Pipe Line Co., the Buckeye Pipe Line Co., the Northern Pipe Line Co., and the New York Transit Co., went with the Standard organization at an early age and rose steadily, being a pipe line company president at the time of the dissolution in 1911.

R. C. Kuldell, president of Hughes Tool Co., Houston, Tex., graduated from West Point Army Engineering School in 1915 and entered the employment of Hughes Tool Co. in 1920 as production superintendent.

In 1912 Ralph T. Zook, one of the leading producers and refiners in the Bradford Field in Pennsylvania, began his career in the industry as manager of the natural gasoline plant of Bessemer Gas Engine Co. in West Virginia. Two years later, with W. J. Sloan, he opened a gasoline plant at Kane, Pa.

Walter W. Fleming, president of the Mid-Kansas Oil & Gas Co. and Marathon Oil Co., and vice president and director of the Ohio Oil Co., started with the latter company in 1904 in Oil City.

W. F. Rollins, division superintendent, Gulf Pipe Line Co., Fort Worth, Tex., was with the Guffey Petroleum Co. at Beaumont, Tex., in 1906. He helped build the first pipe line from Glenn Pool, Oklahoma, to the Gulf Coast in 1907 for Gulf Pipe Line Co.

A. M. McCorkle, vice president, Stanolind Oil and Gas Co., Fort Worth, Tex., was with the Guffey Petroleum Co. at Beaumont, Tex., in 1906. He helped build the first pipe line from Glenn Pool, Oklahoma, to the Gulf Coast in 1907 for Gulf Pipe Line Co.

A. M. McCorkle, vice president, Stanolind Oil and Gas Co., Fort Worth, Tex., was with Dixie Oil Co. in 1921 at Shreveport, La., when that company was absorbed by Stanolind in 1928.

Roy B. Jones, president of the Panhan-

PIONEER EXCHANGERS

BUILT EXCLUSIVELY

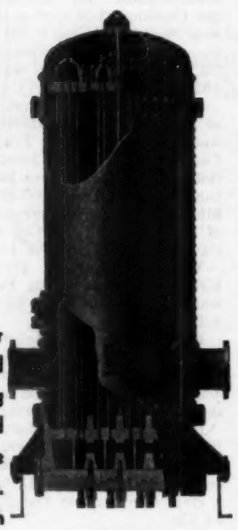
FOR OIL REFINING

1923

IN 1923 the C. H. Leach Company introduced exchangers which successfully withstood corrosion and temperature shock on crude still operations.

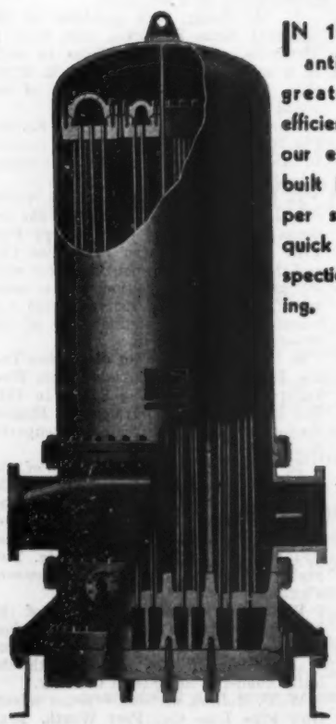
1926

IN 1926 we built the first high pressure, high temperature heat exchanger for operation above 1000 lb. per sq. in. pressure for service on corrosive vapor.



1929

IN 1929 higher anti-knock and greater cracking efficiency required our exchangers be built for 1500 lb. per sq. in., with quick access for inspection and cleaning.



1934

IN 1934 The Leach exchangers are built for any pressure up to 2000 lb. per sq. in., and any temperature up to 900° F. for the most corrosive service.

The advantages of the exclusive Leach features have been proved by more than 11 years of service. The advantages of the original design and its year to year improvement is a matter of proven record. Over 95 per cent of all high temperature, high pressure vapor heat exchangers purchased during 1933 were Leach design and manufacture.

C. H. LEACH CO., Inc.
9-11 Park Place NEW YORK, N. Y.

LEACH Fracto Control

PARRIOTT . . EGLOFF . . SALRIN . . JACOBSEN . . WILSON . . BENEDUM
SINCLAIR . . BLOW . . LEROUX . . HUMPHREYS . . ARNOTT . . BEDFORD
HILTON . . OLIVER . . CHANDLER . . CREVELING . . MOODY . . DONNELL

dle Refining Co., Wichita Falls, Tex., was interested in shallow production in Kansas in 1905, moved to Cushing, Okla., in 1912 and then on south to Wichita Falls, in 1919, when the Burkburnett, Tex., boom was at its height.

L. E. Barrows, division manager of the Texas Co., Fort Worth, joined the sales engineering force of the Texas Co., demonstrating Texaco asphalt for paving in 1909.

C. D. Watson, chief engineer of the Carter Oil Co., started with that company 17 years ago as a draftsman.

Harry D. Frueauff, member of the executive committee of the Cities Service Co. and an officer in several of its subsidiary units, engaged in the various branches of the oil industry, started out in the oil business as a salesman for the company in 1907.

Charles E. Arnott, president of the Socony-Vacuum Oil Co., Inc., entered the oil business in 1896 when he became secretary and general assistant to one of the officials of the Standard Oil Co. of New Jersey, with headquarters in New York City.

William F. Humphreys, president of the Tide Water Associated Oil Co., became officially connected with the oil industry in 1926 when he was appointed chief counsel of the Associated Oil Co.

A. Clarke Bedford, president of the Colonial Beacon Oil Co., and co-ordinator of domestic sales for the Standard Oil Co. (New Jersey), entered the oil business through the Eagle Works of the Standard in May, 1914.

Otto Koch, president of the Kendall Refining Co. ever since it came under its present ownership, was a far-seeing business man who sensed the possibilities of the old Kendall plant in Bradford.

Richardson Pratt, vice president of the Standard Oil Co. of New Jersey and vice president of the Carter Oil Co., was first employed as salesman at the Sone & Fleming Works, Brooklyn, N. Y., of the Standard Oil Co. of New York, starting in the fall of 1919.

C. R. Barton, manager of the manufacturing department of the Tide Water Oil Co., took his first job in the oil business as an engineer with the Mexican Eagle Oil Co., Ltd., of Mexico in August, 1912.

Warren S. Sinsheimer, in charge of all pipe line and domestic oil production for the various oil companies of the Cities Service Co., entered the oil business in Santa Maria Field in California in 1907 as a roustabout.

Frederick S. Fales, vice president of the Socony-Vacuum Oil Co., Inc., and member of the executive committee, became assistant manager of manufacturing department of the Standard Oil Co. of New York, now a part of the Socony-Vacuum, in 1903.

Russell B. Brown, compliance director in enforcement of the code for the petroleum industry, was an attorney at Ardmore, Okla., at the time of the big gasoline tank car explosion and he handled the resulting suits in a manner entirely satisfactory to both sides. Later he was general counsel of the Independent Petroleum Association and secretary of the Planning and Coordination Committee.

Earl Oliver of Ponca City, Okla., petroleum engineer and outstanding leader in the movement to stabilize conditions through unit operation, was born on an oil lease near Karns City, Butler County, Pennsylvania, the son of a pumper. He came to Bartlesville, Okla., in 1910 and after oil experience in South America was given charge of all foreign operations of the Marland Oil Co. and made chairman of the domestic operating committee of that company.

T. J. McMahon, vice president of The Texas Pipe Line Co., started as a field gauger and pump station engineer for the Southwest Pennsylvania Pipe Line Co. at Crows Run Pool, Beaver County, Pa.

J. D. Creveling, in charge of natural gas interests of the Doherty companies, entered the business with the Logan Gas & Fuel Co. in Ohio. He went to Bartlesville, Okla., in 1918 as western manager of the gas and gasoline interests of the Empire Gas & Fuel Co.

N. C. McGowen, president of the United Gas System, entered the business as a clerk with the Palmer Corp. at Shreveport, La.

Jacob France, president of the Mid-Continent Petroleum Corp., was one of the original stockholders in Cosden & Co., when it was organized in Baltimore, and was the firm's legal advisor.

O. D. Donnell, president of the Ohio Oil Co., grew up with that company, which his late father headed for many years, and succeeded his father at the latter's death.

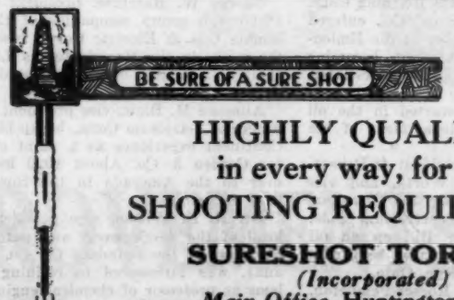
Fayette B. Dow was made Washington representative of the National Petroleum Association and the Western Petroleum Refiners Association in 1918 and became one of the best posted men in the industry on taxation, traffic and other matters relating to the oil business in which the Federal Government was interested.

L. H. Prichard and J. Steve Anderson, president and vice president respectively of Anderson-Prichard Oil Corp., helped make history in the Oklahoma City Field where they became producers, and followed it up with a completely integrated business.

W. N. Davis, vice president of the Phillips Petroleum Co., has devoted much time, energy and ability in fighting the battle of the general industry in matters of state and Federal taxes and was one of the pioneers in unit operation of oil pools.

J. C. Shaffer and W. A. Delaney, who recently opened big production in Wilcox deep sand in the Fitts Pool in Oklahoma, are among the latest operators to enter the list of notably successful wildcatters.

Theodore M. Towl lived on a farm adjoining the Rockefellers at Brooklyn, Ohio. He became associated with the oil industry in its infancy and became a member of the board and head of the real estate and tax division of the Standard Oil Co. He was the progenitor of a distinguished oil family.



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CRUDE OIL PRICES IN FIFTH PERIOD RANGED FROM AVERAGES OF $3.07 TO 60 CENTS PER BARREL

PRICES—ERA NUMBER 5 1919-1934

The fifth period of the oil industry was one of tremendous production. It was the golden period of the petroleum geologist and geophysicist and petroleum engineer. Refinery technique attained a much higher place than it had known before. Pipe line transportation improved to a high degree. It might be said that the industry was overproductive of oil and oil products because it was overproductive of brainy young fellows who did things more efficiently than their fathers had done in the 60 years of the four preceding periods.

In large measure the rotary drill superseded the cable tool, penetrating the earth so swiftly as to make it possible to drill deep holes in incredibly short time, tending to the completion of too many wells per week in the flush fields of which the fourth period was so prolific.

The serious study of unit operation of oil properties began in this period and was tried successfully in a number of fields. The spacing of wells so that each well would drain a greater acreage than before became almost the general rule in the Oklahoma and Kansas deep sand fields, and in some of the flush Texas fields.

The "physically impossible" 10,000-foot well became a reality without the use of freakish equipment thought necessary by the early engineers who dreamed of drilling to such a depth with doubts of ever reaching it.

Wide Range in Prices

The average price of oil in 1920, $3.07 per barrel for the whole United States, was the highest average price since 1872, and has never been approached since. In the period from 1919 to 1933, both inclusive, the U. S. Bureau of Mines gives the production of the United States as 11,075,002,000 bbls., valued at $14,919,055,000, or an average of $1.347 per barrel. This looks like a high average and in the first eight years of the period the average was quite satisfactory to the producer, ranging from $3.07 per barrel down to $1.34 per barrel with an average in the eight years of $1.84 per barrel, but in the period from 1927 to 1933, both inclusive, the average fell from a top of $1.30 per barrel to 60 cents per barrel last year, or an average for the past seven years of $1.01 per barrel.

In the course of the 15 years the highest posted prices paid producers were in 1920 and the early days of 1921. Pennsylvania Grade crude brought $6.10 per barrel. Corning, Ohio, crude went up to $4.25 per barrel; North and South Lima to $3.73; Wooster, Ohio, $4.05; Ragland, Ky., $2.00; Illinois, $3.77; northeastern Indiana, $3.63; Princeton, Ind., $4; Kansas and Oklahoma, $3.50; Healdton, Okla., $2.75; Corsicana heavy, $2; Corsicana light, $3; Electra and Henrietta (North Texas), $3.50; Caddo, La., from $2.50 to $3.50, according to gravity; DeSoto, La., $3.40; Crichton, La., $3; Red River, La., $1.50 to $2.55, according to gravity; Homer, La., $3.10 to $3.25; Gulf Coast Texas and Louisiana, $2.50; Somerset, Ky., $4.25 and $4.50; and western Kentucky, $3.75. In the Rocky Mountain fields prices ranged from $2.05 to $3.10, with Salt Creek crude at $2.75.

PRODUCTION AND VALUE OF CRUDE OIL IN THE UNITED STATES 1919-1933, BOTH INCLUSIVE

Year	Production (bbls.)	Value at well	Av. price per bbl.
1919	378,367,000	$760,266,000	$2.01
1920	442,929,000	1,360,745,000	3.07
1921	472,183,000	814,745,000	1.73
1922	557,531,000	895,111,000	1.61
1923	732,407,000	978,430,000	1.34
1924	713,940,000	1,022,683,000	1.43
1925	763,743,000	1,284,960,000	1.68
1926	770,874,000	1,447,760,000	1.88
1927	901,129,000	1,172,830,000	1.30
1928	901,474,000	1,054,880,000	1.17
1929	1,007,323,000	1,280,417,000	1.27
1930	898,011,000	1,070,200,000	1.19
1931	851,074,000	553,630,000	.65
1932	785,143,000	683,074,000	.87
1933	898,874,000	539,324,000	.60
Total 15 years	11,075,002,000	$14,919,055,000	1.347

10-Cent Oil

Compare the above with the prices at the lowest point in the whole period which was in May, 1933, when Pennsylvania Grade oil dropped to prices ranging from 77 cents in southeastern Ohio, 92 cents in West Virginia, 97 cents in Southwest Pennsylvania and from $1.17 to $1.27 per barrel in northwestern Pennsylvania and in New York. In that month northeastern Indiana fell to 25 cents; Princeton, Ind., to 47 cents; Lima, 55 cents; Illinois, 47 cents; western Kentucky, 42 cents; Somerset, Ky., 50 cents; while in Kansas, Oklahoma, North Central, East Central and East Texas a price of 25 cents for crude of any or all grades was posted because the East Texas Pool was pouring out over a million barrels of oil per day, Panhandle crude fell to 18 and 20 cents; Gulf Coast to 30 cents; Southwest Texas to 23 and 25 cents and West Texas to 20 cents. Rocky Mountain posted prices ranged from 20 to 65 cents according to field. California prices went to their lowest in the period from March 5 to June 26, the lowest price in the state having been 55 cents and the highest 96 cents (for 38 gravity oil in Santa Fe Springs.) The 25-cent price in the "sweet crude" fields of the Mid-Continent was not the lowest in the period, as from July 8 to July 23 in 1931, the price fell to from 10 cents to 22 cents, according to gravity, with the average Kansas crude selling at 10 cents; North Texas and East Central Texas, 19 cents; Oklahoma crude, 18 cents, and the North Louisiana at 19 cents. This was occasioned also by the flood of crude coming out of East Texas. The big buyers appeared to think that the only way to stop the East Texas oil flood was with prices so low that the hot oil producer could not go below them. The 1931 low prices in the Mid-Continent did not affect other fields as seriously as did the 1933 low prices.

Great Fields Opened

The following big fields were opened in the fifth period: Hewitt, Okla., and Elk Hills, Calif., in 1919; Huntington Beach, Calif., and Burbank, Okla., in 1920; Long Beach, Calif., and Mexia, Tex., in 1921; Smackover, Ark., Tonkawa, Okla., and Torrance, Calif., in 1922; Powell, Tex., in 1923; Crane-Upton Field, Texas, Seminole Field in Oklahoma and Hendrick, in Texas, in 1926; Yates Pool, Texas, in 1927; Oklahoma City, Okla., in 1928, and East Texas Field in 1929.

All of the above named fields have been exceptionally large producers ranging from 70,000,000 bbls. up to 564,000,000 bbls., the latter production being that of the East Texas Field up to August 15, 1934. Many other pools were opened in the period that do not rank with the above fields, but which, in the aggregate, produced a large volume of new crude and helped materially to build production up to the 11,000,000,000-bbl. total it attained in the 15 years.

Among these are Big Lake, Luling, Joe Bruner, Mirando, Archer County, Spindletop deep sand, Chalk-Settles, Barbers Hill, Darst Creek, Van, Conroe and Refugio Pools in Texas; Inglewood, Dominguez, Kettleman Hills, Rosecrans, and Seal Beach, in California; Allen deep sand, Sholem Alechem, Tatums, Bristow, Cromwell, Wewoka, Papoose, South Burbank, Naval Reserve, Fitts, Crescent, Lucien and Olive, in Oklahoma; all the pools in Sumner, Sedgwick, Harvey, McPherson, Reno, Rice, Ellsworth, Russell, Kingman and other counties in central and western Kansas and several pools in Greenwood, Cowley and Marion Counties in the same state; the El Dorado Field in Arkansas; Lea County pools in New Mexico; Sunburst, Montana; Leesville and Iowa in Coastal Louisiana; Haynesville and Homer in northern Louisiana. All the Michigan fields were opened in the fifth period and one of them, Midland, is a major field in production.

The above list may not be a complete roster of the important discoveries of the 15 years, but it indicates the large number of really important pools being developed in the 15 years. In addition to all of the above scores of pools of lesser importance were opened, every state that produces oil contributing more or less, all of which added to the immense total of crude produced.

Summing Up

To sum up the production and prices from the late summer of 1859 down to the end of 1933 we find that 15,683,574,000 bbls. of crude oil have been produced in the United States valued at $19,447,922,000 or an average of $1.24 per barrel. The figures by 15-year periods follow:

U. S. PRODUCTION AND VALUE FOR 75 YEARS

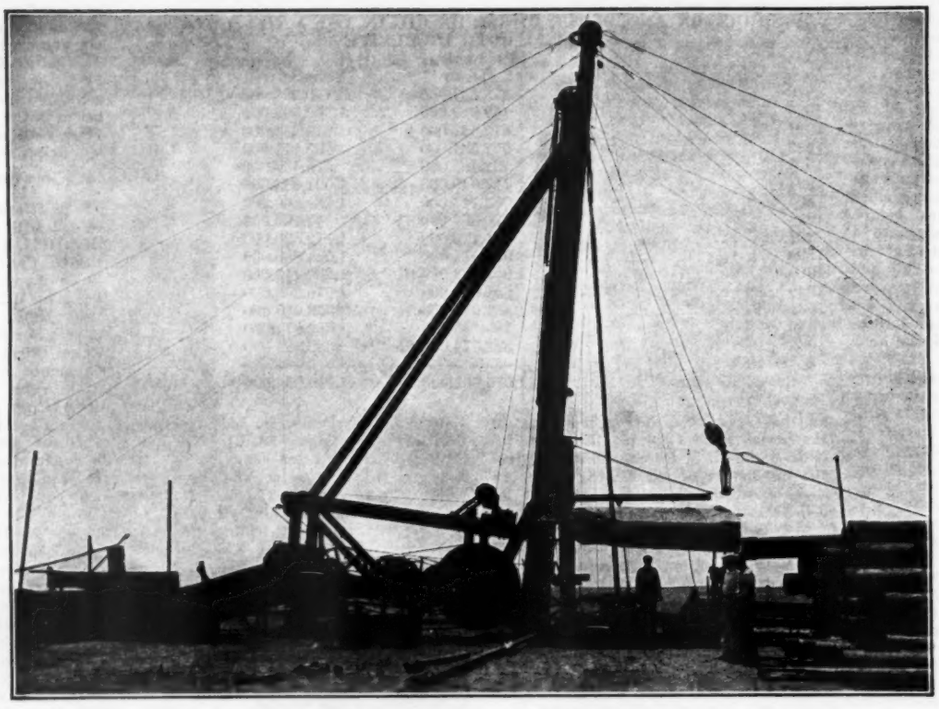
Period	Production (bbls.)	Value at well	Av. price per bbl.
1859-73	54,357,000	$195,766,000	$3.60
1874-88	315,293,000	306,130,000	.97
1889-03	892,572,000	757,335,000	.848
1904-18	3,346,350,000	3,269,036,000	.98
1919-33	11,075,002,000	14,919,055,000	1.347
Total	15,683,574,000	$19,447,922,000	$1.24

Tanker being loaded with crude oil

Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

Fort Worth Spudders

for depths to 4000 feet



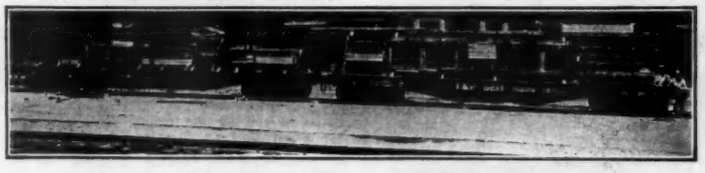
Super J in action - Big Spring, Texas District

In almost every oil producing section of America, in many foreign lands and under every known drilling condition where cable tools are used, Fort Worth Spudders have proved our claim of more hole at less cost.

Fort Worth Spudders have filled a definite need in the petroleum industry for more than two decades. As proof of their high standing an order for six Super J's for export shipment has recently been placed with us. We are told a rigid investigation of all makes and types of portable drilling machines was made before the order was placed. Records of hundreds of Fort Worth Spudders rendering fine service after years of operation and severe punishment such as only the oil fields know, were determining factors in the selection of this equipment.

There is a Fort Worth Spudder to meet your requirements. We manufacture eight different sizes ranging from model L with a drilling capacity of 700 feet to the Super J (illustrated) with hole making records to depths of around 4000 feet, and and capable of more.

Write to us for specifications and prices on equipment for your next job. Remember—— Fort Worth Spudders make more hole at less cost.

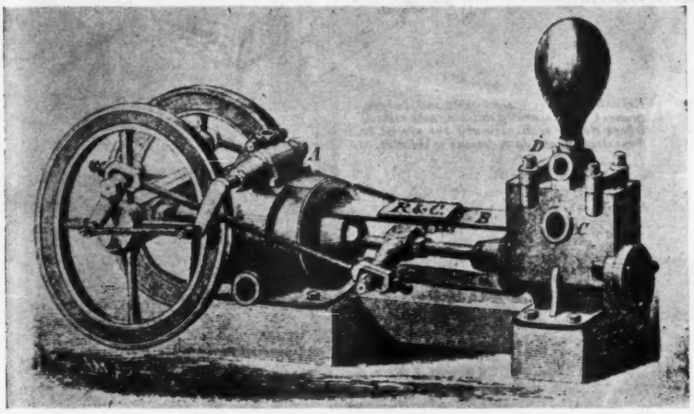


One of an order for Six Super J Fort Worth Spudders crated, for export shipment.

Well Machinery & Supply Company

FORT WORTH ⁘ ⁘ TEXAS

PUMPS WERE DEVELOPED TO CARE FOR GROWING NEEDS OF PIPE LINES



First pipe line pump. Used on Van Syckel line

As pipe line systems developed and expanded, the need for better pumps became more evident. Pumps used on the first successful pipe line—the Van Syckel line—were of the two flywheel type. Another type, having a single wheel, was also in use about this time. This was known as the "Old Hero" pump. A little later the flywheel pump gave place to a simpler, less expensive type—a single, direct-acting steam pump. From 1865 until about 1875 the handling of oil in pipe lines was confined mostly to small gathering lines and the pumping equipment consisted mainly of these single steam pumps. These were simple, inexpensive machines and for small pipe and short lines, where the pressure was not great, they were fairly satisfactory.

However, it was soon found that this single type of pump was totally unsuited for trunk line work. The column of oil had to be stopped and started again at each reversal of the pump. With the high pressure necessary in trunk line work, this produced a constant shock that resulted in burst lines, stripped threads and broken down pumps. Some of these single pumps had steam cylinders as large as 30 inches in diameter, driving 5-inch oil plungers and the reversal sounded like the report of a gun.

Then came the duplex type of steam pump, and from the very first it was heralded as a great success. The first installation of this type was near Bradford, Pa., in 1877 on a 4-inch line, 16 miles from Bradford to Carrollton, N. Y.

Rush Then Same as Now

In equipping pipe line pumping stations, there was always a rush to get the oil moving. Later on economy of operations began to be considered and improvements commenced. Direct-acting steam pumps were supplanted by the more economical crank and flywheel pumping engines. When the crank and flywheel pump engines were first proposed for trunk line work, they were met with the usual objections by the ultra-conservatives but the progressives went on, and after a little while a triple-expansion condensing, crank and flywheel pumping engine was built and installed at Knepper, Pa., pumping station in June, 1891. This was a 36-inch stroke machine with 24⅛-inch, 38 and 54-inch steam cylinders and 6-inch plungers. The immediate success of this type was the reason for its general adoption on the various pipe lines throughout the country. This first machine was followed by more than 150 others of practically the same type. These were all horizontal six-plunger pumps, the steam end having a Corliss valve gear.

In a trial conducted in September, 1914, of one of the horizontal type pumping engines on a western pipe line, it was found that with 1 bbl. of oil fuel burned under the boilers through a steam burner, the pump was able to handle 1,000 bbls. of oil against a constant line pressure of 600 pounds.

Flywheel pump engines, giving comparatively good economy, were considered the standard trunk line equipment for many years. Then the oil engine, burning a low grade oil began to claim the attention of engineers. Pipe line companies were among the first to consider the advisability of installing these engines in pipe line service.

The Tide Water Pipe Co. is credited with being the pioneer in the use of internal combustion engines. As early as 1901, two of the eastern stations were furnished with these engines, operated by gas. From then on, this type was used throughout, with various changes as new and improved models were put out. On account of the falling off in gas supply in some points, the oil engine pumping units were installed to supplement them.

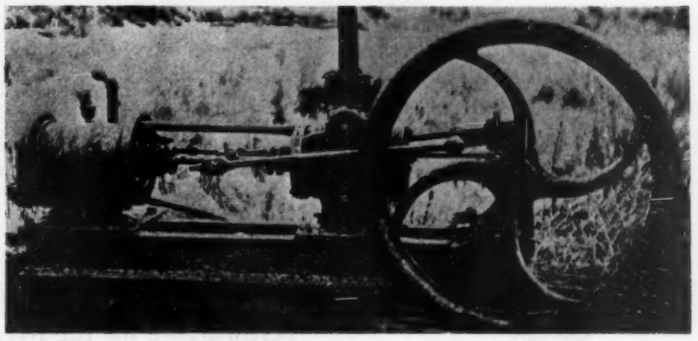
Oil-Burning Engines

The De La Vergne Machine Co. started building in 1893 the Hornsby-Ackroyd engine under English license. This was an engine of low compression (50 pounds per square inch), hot-bulb type. This company evolved from this engine, through a number of gradual steps, a modern type of high compression, solid injection, cold starting engine, now known as a Diesel engine, yet in which the work of Doctor Diesel had no part whatever.

The Hornsby-Ackroyd engine antedates the Diesel as a self-ignition engine. Despite its poor fuel economy and its inability to consume heavy crude oils, it was the first oil engine used for oil pipe line pumping. Arthur H. Goldingham, of the De La Vergne Machine Co. and the Standard Oil Co. of New Jersey, respectively, were responsible for the first installation which was made at Fawn Grove, Pa., in 1902. By 1906 some 50 of these engines, in cylinder sizes up to 27"x33", had been put in service on various oil pipe lines.

Realizing the desirability of an engine with better fuel economy and particularly one that could use the heavier grades of crude oil, the De La Vergne Machine Co. brought out in 1908 a design of the hot-bulb type but with higher compression (280 pounds) and air injection. Alexandro Franchetti was the designer, and the engine was known as Type FH. The combination of air atomization and hot-bulb facilitated the clean burning of heavy, asphaltic fuels and permitted the use of a lower compression than with the usual air-injection engine. Maximum pressures were about 450 pounds and excellent fuel economy was obtained.

The Type FH engine was at that time the only engine suitable for oil pipe line use, with heavy crude oils as fuel, and for about five years dominated this field of application. In those days the commercial demand for heavy oil engines came almost wholly from the oil pipe lines. This type of engine was built in large numbers for many years, but by 1914 the advent of the Price solid-injection engine, coupled with competitive improvements in high-combustion, air-injection engines caused it to be superseded.



Old Hero pipe line pump

The commercial history of the Diesel engine in the United States dates from this time.

Companies Test Diesels

In 1913 several pipe line companies in the Mid-Continent began to test out Diesel engines for pump station use. One installation was made at Neodesha, Kans., another at Caney, Kans., on the Prairie line, and still another at Jenks, Okla., on the Oklahoma Pipe Line System. These were all of the semi-Diesel or hot plate type of engines. In each case several 100-horsepower, four-cycle, horizontal, single cylinder engines, coupled to vertical triplex pumps of about 7,000 bbls. a day capacity were set up to compete directly with existing steam plants on these lines. Trials demonstrated that the oil engine could hold its own in the way of service demanded on pipe lines.

A year later, two larger installations, consisting of two-cylinder, 300-horsepower engines, each of the same type, were set up at other points, and at about the same time an entire oil engine line, with four pump stations, was built across the State of Missouri. Other installations followed rapidly.

In 1915 the full Diesel engine in larger sizes made its appearance on pipe lines and about a year later all Mid-Continent companies were engaged in extensive programs of changing over from their old steam equipment to Diesel engine drive.

The typical installation by one large pipe line company shows the trend in pumping equipment during this period.

Electric motor driven centrifugal pipe line pumps

SERVING AN INDUSTRY

Republic plates and sheets and Upson rivets, nuts and bolts build long life and low upkeep into tank trucks.

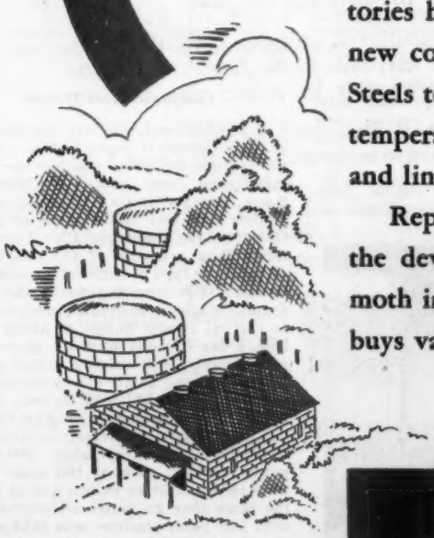
Republic Electric Weld Casing and Tubing, grades C and D, are establishing new records where deeper wells demand the utmost in joint strength and in resistance to collapse.

Modern service stations like this of the Standard Oil Company of Ohio are using Toncan Enameling Iron Sheets with Enduro, Republic's perfected stainless steel, as decorative trim. Enduro will not rust, is easy to clean and outlasts the structure.

MILLIONS of dollars are spent annually by the producing, refining and transporting divisions of the petroleum industry for new equipment. Any failure of material is so costly that guesswork simply must be eliminated.

Sensing the changing demands of the industry, Republic long ago planned to keep a step ahead—to be a leader in the movement to substitute positive performance for the hazard of chance. Since then, from Republic's laboratories have come new wear-resisting Agathon alloys to speed-up drilling—new corrosion-and-heat resisting alloys, Toncan Iron and Enduro Stainless Steels to challenge salt-and-sulphur laden crudes, and to bring safety to high-temperature operations—and a new method of making better casing, tubing and line pipe by Republic's now famous electric resistance welding process.

Republic has never been afraid to pioneer—to spend time and money in the development of better steels to meet the specific needs of this mammoth industry that can't afford to guess, yet must see that every dollar spent buys value plus.



Republic offers a complete line of plain and corrugated sheets for roofing and siding of field buildings, in Toncan Copper Molybdenum Iron, copper bearing steel and plain steel.

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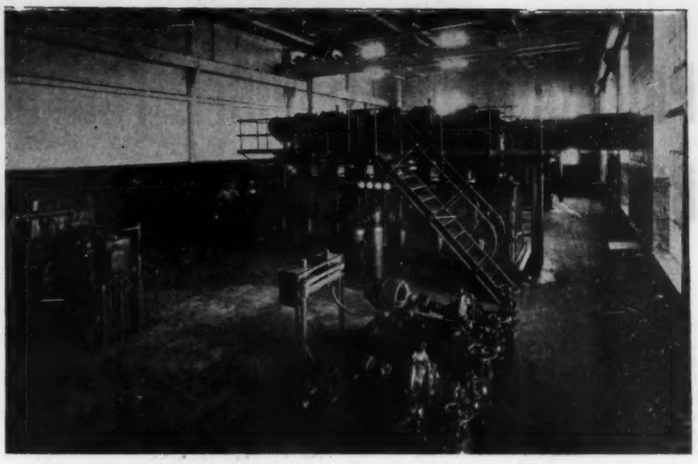
ALLOY AND CARBON STEELS • TONCAN IRON • STAINLESS STEEL • PIPE AND TUBULAR PRODUCTS • BARS AND SHAPES • HOT AND COLD ROLLED STRIP PLATES • BLACK, BLUE ANNEALED, GALVANIZED SHEETS • SPECIAL FINISH SHEETS • TIN PLATE • NUTS, BOLTS, RIVETS, ETC. • WIRE PRODUCTS • DIE ROLLED PRODUCTS

Reciprocating type pumps driven by Diesel engines



Diesel engine side of a modern pipe line pump station

In 1917 this company installed 250-horsepower units, 18"x28", 200 r.p.m., horizontal, air injection, four-cycle engine. The same year it installed a 250-horsepower, 13¾"x17", 257 r.p.m., vertical, air injection, four-cycle engine.

In 1922 it installed units of the following sizes: 400-horsepower, 16½" x24", 200 r.p.m., vertical, air injection, four-cycle engine; 365-horsepower, 16¼"x21½", 225 r.p.m., vertical, air injection, four-cycle engine; 440-horsepower, 15"x20", 225 r.p.m., vertical, air injection, four-cycle engine; a 520-horsepower, 22"x30", 164 r.p.m., vertical, air injection, four-cycle engine and a 440-horsepower, 15"x20", 225 r.p.m., vertical, air injection, two-cycle engine.

In 1931 this company installed 750-horsepower, 17½"x25", 240 r.p.m., vertical, solid injection, four-cycle engine; a 750-horsepower, 16"x21", 257 r.p.m., solid injection, two-cycle engine; a 300-horsepower, 9"x11", 750 r.p.m., vertical short pipe line in California. At about this time, and during the succeeding year or two, several motors were installed to drive plunger pumps in pipe line stations in Oklahoma.

During these years manufacturers of centrifugal pumps were working on the development of a centrifugal pump for oil pipe line service. In 1926 centrifugal pumps for handling oil under oil pipe line conditions were offered to the industry. In June, 1926, one large pipe line company agreed to try out motor-driven centrifugal pumps in a main line station. These pumps were installed in November, 1926, at Westbury, Tex., near Beaumont. The pumps, driven by 250-horsepower, 3,600 r.p.m. motors, handled approximately 30,000 bbls. of Luling crude per day at approximately 550 pounds pressure. The operation was considered successful. These pumps later were moved to the Texas Panhandle and were placed in regular operation early in 1927.

Two centrifugal pumps, driven by 300-horsepower, 1,800 r.p.m. motors, were installed at a pipe line station at Henryetta, Okla., in February, 1927.

In 1927, 1928 and 1929 several pipe lines that used motor-driven pumps, both reciprocating and centrifugal, were constructed to take oil out of the East Texas producing area to the Gulf Coast. It is estimated that the total capacity of pipe lines constructed to move oil out of West Texas on which motor-driven pumps were used in part or in whole was approximately 300,000 bbls. per day. The total electric horsepower installed to drive pumps on these lines was approximately 85,000.

Advantages claimed for the motor-driven centrifugal pump are that it is a relatively small, light, inexpensive unit, easily and quickly installed, requiring a small building and no surge tank, has a low maintenance cost and requires a minimum of labor to operate.

At the present time it is estimated that there is in excess of 200,000 horsepower in electric motors installed on pumps in main lines, oil or gasoline pipe line stations. These motors range in size from 150 to 1,000 horsepower.

Reciprocating type pipe line pumps

Engine side of pipe line pump station powered with horizontal type Diesel engines

horsepower, 15"x20", 225 r.p.m., vertical, air injection, two-cycle engine; a 520-horsepower, 19"x24½", 200 r.p.m., vertical, air injection, two-cycle engine; a 750-horsepower, 17"x25", 180 r.p.m., vertical, air injection, four-cycle engine; a 750 horsepower, 20¾"x26", 180 r.p.m., vertical, air injection, two-cycle engine.

In 1923 this same company equipped a new line with units as follows: 600-horsepower, 16½"x24", 200 r.p.m., vertical, air injection, four-cycle engine; a 500-horsepower, 16½"x24", 200 r.p.m., vertical, air injection, four-cycle engine; a 500-horsepower, 16¼"x23½", 225 solid injection, four-cycle engine, and in 1933 a 750-horsepower, 17½"x25", 257 r.p.m., vertical, solid injection, two-cycle engine. These installations indicate the latest trend was toward higher speeds and solid injection engines.

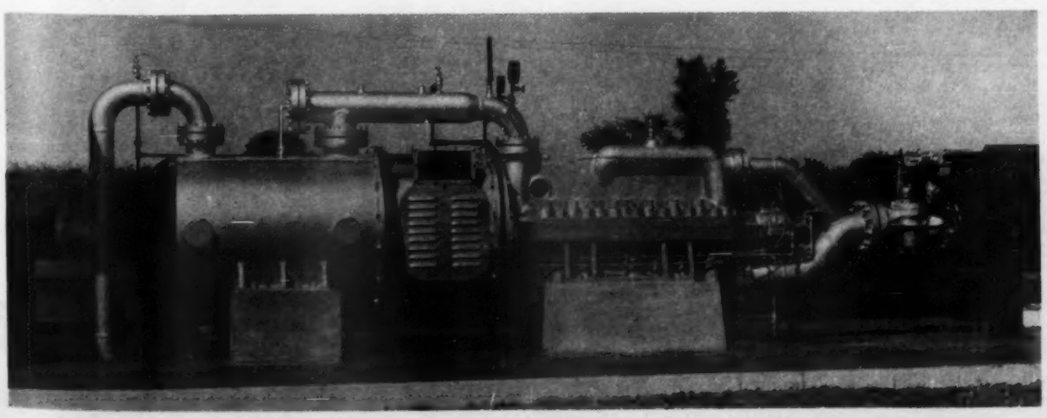
Advent of Electric Drive

With the rapid development of the electrical industry throughout oil-producing areas, it was only natural that electric motors would be considered for driving oil pipe line pumps. In 1923 two motor-driven pumps were installed on a

Fluid Cooled Pump

In 1932 Dan Moran, president of the Continental Oil Co., and E. O. Bennett, chief engineer of the same company, invented and patented the Rannett pump to fill a needed requirement for low cost, economical pipe line pump stations which could be speedily installed.

The pumping unit consists of an eight-stage centrifugal pump, connected to a two-pole squirrel cage induction motor. A feature of the unit is the fact the electric motor is cooled by the gasoline or other fluid being pumped by the unit. Mobility and ease of installation are features appealing to pipe line men. The whole unit, only 19 feet long and weighing about 26,000 pounds, can be hauled to a station site on an automobile truck and installed and placed in operation on a line within two hours after arrival at the site.



The Rannett pump

PROTRACTED STRUGGLE FOR CONSERVATION BROUGHT TO FOCUS BY FEDERAL OIL CODE

The oil industry differs from all others in the peculiarities surrounding the finding and production of its raw material. First, because of the element of chance in finding it, which has not by any means been wholly removed even by the most modern scientific methods. Second, because of the competitive necessity to produce it since the legal classification of oil with wild game required reduction to possession to establish ownership.

In the days immediately succeeding Drake's discovery finding oil was almost entirely a matter of luck and indeed for many years thereafter during which wells were drilled on "hunches" or on the similarities of locations to previous oil-producing spots.

This recognized element of uncertainty, together with the legal classification of oil as wild game, gave to the search for oil all the sporting atmosphere of hunting and gambling and led naturally to the familiar reference to the business as "the oil game."

But it was not long until the pioneer producers discovered that there was a lot more to it than sporting chances. The oil man might be overwhelmed with too much of a good thing. The much sought for and prized "game" might be found so plentifully that it would glut the market and fail to pay the hunter for his efforts. So that while the finding and production of oil continued to be subject to the vicissitudes of chance the reward of the hunters was measured by the rigid laws of economics. Crude that brought $20 a barrel from the Drake well dropped to 10 cents when the hunters bagged too much "game."

This "embarrassment of riches" beset the producers early. Those who had found too much oil quickly realized that the remedy would be to lessen production until the surplus was used. But those who were just entering "the game," attracted by the reports of fabulous fortunes to be made by lucky prospectors, kept on drilling and finding and producing. And some of the producers, even then, expected the other fellows to do the reducing while they continued to produce.

Proposed Shutdown in 1866

Overproduction, however, continued to swell. Towards the close of 1866 producers were holding meetings to secure better prices. In the following year the Producers Protective Association, of which Captain William Hasson was president, proposed to shut down all work on Sundays, start no new wells for 90 days and cease using torpedoes to increase the flow. The National Refiners Association offered to buy 200,000 bbls. from the Producers Association at $4 a barrel if refined oil was sold for 26 cents a gallon, crude to be raised 25 cents for every one-cent rise in refined products. About 50,000 bbls. were bought and then the contract was cancelled. The producers who had agreed to limit production to 15,000 bbls. a day were overproducing 5,000 bbls. daily, the guaranteed price stimulating production.

The discovery of the Bradford Field was the next crisis. A meeting of producers in June, 1877, refused to agree to a shutdown. Instead, it adopted this significant resolution:

"Whereas, the shortest way to $2 oil is through 25-cent oil, therefore, be it resolved: that we favor pushing the drill as rapidly as possible."

It is noted, too, that drillers who were favorable to shutdown were being harried by royalty owners who insisted upon continued production.

Ten years later the efforts of the Producers Protective Association for a general shutdown in Pennsylvania were more successful. It was continued into 1888 and while the pecuniary results were not as great as hoped it did reduce the overhanging crude stocks considerably.

In Days of Cushing

Regulation in Oklahoma dates back to Cushing in 1914. Fearing the flood of oil would wreck the market, the state commission relieved the pipe lines from taking production from new wells. A. E. Watts was named umpire.

The commission's order stated the case very plainly when it asked operators "to sacrifice some personal advantage which to some extent may have been due to their own diligence" in order "that this great industry might not fall into contempt by reason of the destructive production of crude."

Similar action was taken at Healdton. One of the early orders said that no more oil should be taken than could be sold at 65 cents a barrel and no one should buy at less. This was amended to 55 cents when an order was issued that no well be drilled without permission.

These orders, however, seem to have been ineffective since the producers at Ardmore were soon complaining of cheating and waste.

This was the traditional background which the industry had to overcome when, following the flood from California in 1923, advocates of curtailment began to urge co-operation against overproduction.

The imperative need for oil during the war and the drain upon reserves had stimulated the search for production. The discovery of seven new fields in one year, the availability of California oil through the Panama Canal, coming for the first time into serious competition with the rest of the country, threatened the market. Proration of runs was put into effect in July, 1924, with the hope of limiting output. In the Burbank Field operators agreed upon a restriction of drilling.

But the general thought was that, like all other periods of overproduction, it would soon pass and the idea was to get rid of it as soon as possible. The Bradford meeting resolution of 1877 that the shortest way to $2 oil is through 25-cent oil persisted as it does to some degree to this day.

That was the way the industry had always passed through periods of overproduction and suggestions of voluntary curtailment were met with scoffs. The repeated failure of curtailment movements in the past were cited as proof positive that oil men could not be got to stick together, so why waste time discussing it?

State regulation of production, notwithstanding the efforts of the Oklahoma commission in the days of Cushing and Healdton, which were regarded rather as freakish incidents, was scarcely discussed because oil men believed firmly in their inalienable right to do their own regulating.

Coolidge Names Oil Board

Meanwhile the campaign of education in the benefits to be derived from curtailment, contrasted with the effects of wide open production, was making headway. Far-sighted leaders of the industry were seeing it in a new light. They deplored the economic waste of oil at distress prices and pondered steps to check it.

Then in December, 1924, President Coolidge announced the creation of the Federal Oil Conservation Board in a historic letter in which he said "it is evident that the present method of capturing oil is wasteful to an alarming degree." Overproduction, he said, in itself encourages cheapness, which in turn leads to wastefulness and disregard of essential values. Government and business, he said, can well join forces to work out this problem of practical conservation, but "the oil industry itself might be permitted to determine its own future."

The American Petroleum Institute promptly decided to co-operate in this development. It appointed a Committee of Eleven to review the statistical and economic position of the industry, which report was published in book form. The Institute retained Charles Evans Hughes to represent it at the hearings before the Federal Oil Conservation Board which consisted of the Secretaries of the Interior (Chairman Hubert Work), War, Navy and Commerce.

Chairman Work's first report took the position that the power of the Federal Government to regulate oil production is doubtless limited to its own oil lands, and suggested that "the several States should protect property rights in oil produced from a common underground supply."

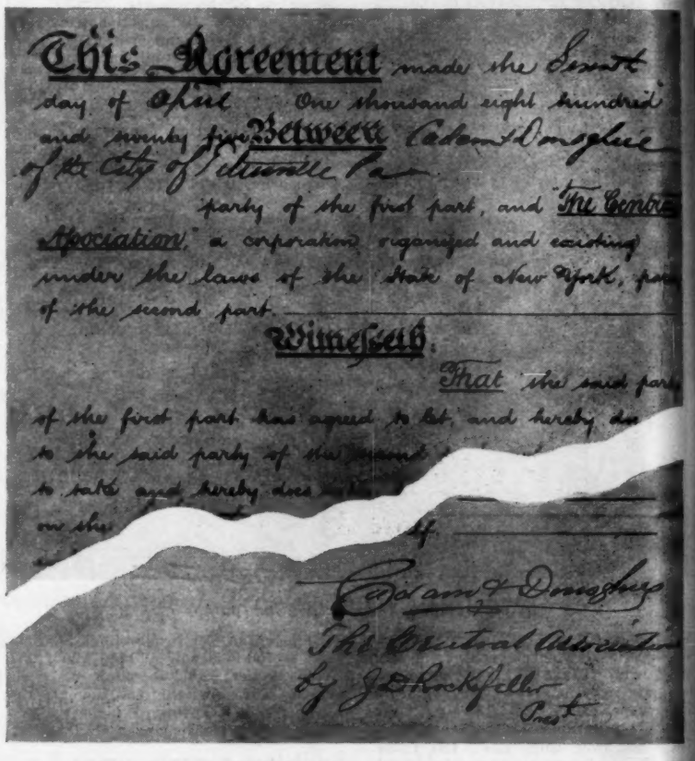
A committee of seven had been appointed by the directors of the American Petroleum Institute to consider the problem of overproduction, and E. W. Marland, as chairman of the committee, presented to Chairman Work of the Federal Oil Board a tentative bill to be presented to the states to require the establishment of oil-gas ratios, the licensing of drilling, etc. A similar bill was introduced in the Oklahoma legislature and caused much controversy, but failed to pass.

Seminole had been opened in 1926, and Oklahoma City in 1928. The hope of getting over the period of overproduction was being pushed farther away. Curtailment became not only desirable but essential.

Ray M. Collins was chosen umpire in the Seminole Field in an effort to restrict production but the early attempt failed.

State-wide proration was established in Oklahoma on September 8, 1928. By this time the industry had come to realize that since hope of voluntary curtailment had failed, reliance must be had upon the assistance of state regulation. The Federal Oil Board had consistently stressed the necessity for state regulation and the industry and the states were trying it.

When Mr. Hoover, who had been a member of the federal board, became president, Ray Lyman Wilbur, as secretary of the interior, became chairman.


This Agreement made the Seventh day of April One thousand eight hundred and ninety five Between Calvin Donaghue of the City of Titusville Pa. party of the first part, and The Central Association a corporation organized and existing under the laws of the State of New York, party of the second part.

Witnesseth.

That the said party of the first part has agreed to let, and hereby does to the said party of the second to take and hereby does on the

Calvin Donaghue

The Central Association

by J. D. Rockefeller Pres't

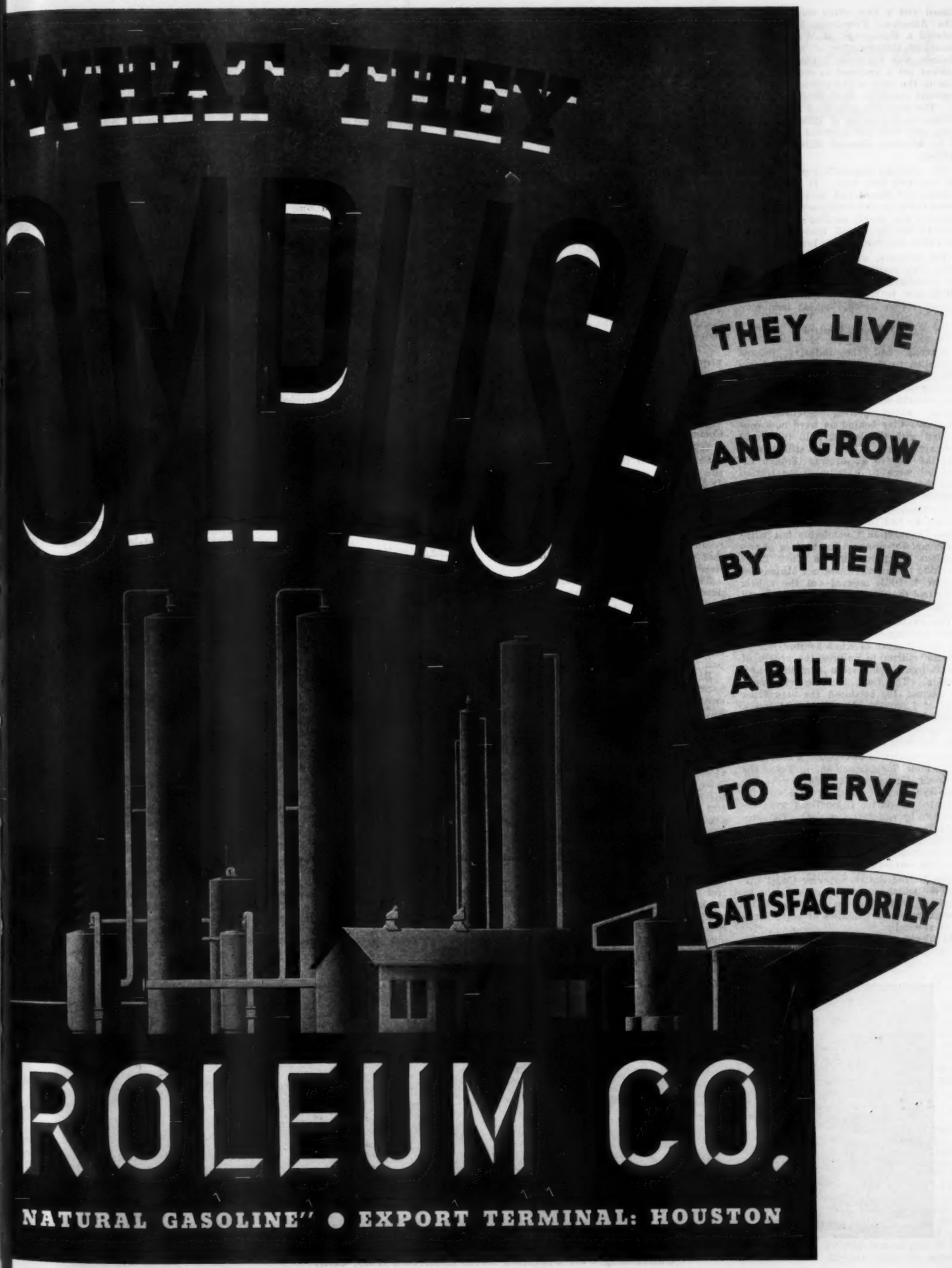
Portion of agreement signed in 1875 by John D. Rockefeller

Interstate Compact Idea

Chairman Wilbur called a meeting at Colorado Springs in June, 1929, to consider an interstate compact for control of oil production. Mark Requa was appointed presiding officer, his opening address creating an impression that the industry was to be coerced into the compact which, though denied by Mr. Wilbur, provoked much resentment. The meeting was barren of results except that as an outgrowth of it an agitation was begun for a tariff on oil which led to the formation of the Independent Petroleum Association with Wirt Franklin as president.

The failure of the interstate compact idea led to the substitution of the Oil States Advisory Committee composed of representatives of 10 oil producing states appointed by the governors or the state regulatory commissions. Conferences were arranged to frame tentative allowables from Oklahoma, Kansas and Texas, but the effects were not important.

Despite all efforts, overproduction con-



Diamond Jubilee of the Petroleum Industry, Aug. 27, 1934.

tinued and a new effort was attempted. The American Petroleum Institute appointed a Committee on World Production and Consumption of which R. C. Holmes was chairman. This committee worked out a proposal to reduce production to the total of the previous year and regional meetings were held to approve it. The plan was presented to Chairman Wilbur in the spring of 1929 and apparently met with his approval but he sent it to Attorney General Mitchell for an opinion.

The attorney general's reply destroyed all that had been done. It declared the Federal Oil Board had no power to approve the plan and intimated that the oil industry was simply seeking an immunity bath by having the oil board approve a plan that was contrary to law.

The industry, which had acted in good faith, was justifiably indignant, both at the repudiation of the plan it had been encouraged to formulate and by the insinuation that it was seeking immunity.

Military Control

Scarcely had the industry become reconciled to the discovery of Oklahoma City as a further obstacle when the opening of East Texas threw everything else into the shade. Those who had been talking about getting Seminole and Oklahoma City behind us were now confronted with the largest field the world had ever known. Those who still thought that the way to $2 oil was through 25-cent oil were to have a demonstration that there was one field too big to be disposed of that way.

In Oklahoma overproduction at Oklahoma City had been taken hold of by the State Corporation Commission but without complete success. In the face of tremendous overproduction in East Texas wrecking the market Governor Murray on August 4, 1931, ordered out the militia to control the Oklahoma City Field "until oil became a dollar a barrel."

The example was pressed upon Governor Sterling of Texas who hesitated to act until August 17 when he also ordered out the militia to enforce the orders of the railroad commission curtailing production. The field, running wide open on August 16, produced the staggering total of 1,200,000 bbls. within 24 hours. The price had dropped to 10 cents and one instance was reported where 50,000 bbls. had been sold for 2½ cents a barrel.

State regulation in Oklahoma continued with minor fluctuations but in Texas the Railroad Commission's orders were repeatedly appealed to the courts and invalidated in part. Injunctions were resorted to by violators of orders. Enforcement was haphazard. All sorts of devices and dodges were used to evade the order and overproduction continued to demoralize the market.

The United States Supreme Court upheld the Oklahoma commission's right to regulate production on May 5, 1931, strengthening the position of state regulation generally.

In Texas the legislature amended the law to cover economic waste as well as physical waste but test cases were immediately instituted and the effect was hardly apparent.

In California, overproduction has repeatedly demoralized the market. The absence of any state authority to regulate production left the matter to voluntary adjustment which produced no results. A gas conservation law was passed but it proved ineffective in aiding in curbing overproduction because of practical difficulties. A bill to establish an oil and gas commission was passed by the legislature but on being submitted to a referendum was defeated.

Oil Code Initiated

When the Hoover administration went out there was some doubt whether the Federal Oil Conservation Board would be continued. The introduction of the National Recovery Act was followed by the designation of the Secretary of the Interior, Harold L. Ickes, as petroleum administrator, and the invitation to the industry to formulate a code.

The initial meetings at Chicago completed a draft which, later modified, was promulgated as the oil code. The president appointed three members to represent the government and invited the industry to name 12 to represent the industry on the Planning and Coordination Committee, which was to advise the petroleum administration.

One clause of the code prescribed that the price of crude per barrel should be 18.5 times the price of gasoline per gallon. Price fixing was then thought to be the solution in view. But prolonged discussion in the Planning and Coordination Committee and throughout the industry resulted in the dropping of price fixing, that clause of the code having been declared inoperative.

The next idea was a marketing and purchasing agreement within the industry. That occupied attention for some additional months but finally was elbowed aside for the plan to have companies buy excess gasoline in East Texas if the producers would abstain from overproduction. That plan is now being tried.

But in between, the petroleum administrator, apparently despairing of agreement within the industry and discouraged by the failure of state regulation in Texas, had introduced in Congress a bill to give the Federal Government greater control of the industry. Texas opposition in the House and Senate and lack of time at the close of the session resulted in the defeat of the bill. A House committee to investigate the necessity for Federal control was however named and is now engaged in that work, hearings to start in September.

Since the oil code was enacted California companies prepared and presented to Administrator Ickes a plan for a cartel regulation there which promised to control overproduction and stabilize the market on the West Coast. The original cartel, however, failed to find approval from the attorney general and was subsequently modified and is now in effect.

Unitization

H. L. Doherty is usually credited with proposing unit operation of oil pools. He discussed the plan at a meeting of the American Petroleum Institute held at Fort Worth, Tex., in 1924 in such a way as to direct attention of the petroleum industry to the probable merits of the proposal. Many thought that the plan would involve Federal or state government control of production and drilling activities and at that time the spirit of competitive operation ruled the industry and the flood of excess oil had not demoralized the crude oil markets and shown clearly that some form of regulation of rate of production was necessary.

Unitization Defined

Unitization has been defined in a report submitted by a committee acting for the Mid-Continent Oil and Gas Association as follows:

"Unitization is the process by which divided interests in an oil or gas pool containing a number of tracts of land are converted into undivided interests in the entire area; where the owner of the oil or gas rights in an individual tract or tracts of land surrenders his exclusive ownership thereof in return for an assignment to him of an undivided interest in the oil and gas rights of the pool as a whole; the purpose being to develop and operate the area as one property or unit through the instrumentality of a common agent, trustee or committee and thus avoid unnecessary competitive drilling, waste of gas and duplication of effort and secure greater recovery of oil at less cost."

Unit Operation Experiments

At this point it may be observed that while the petroleum industry executives in this country were arguing about the probable results of "unitization" or unit operation, the executives of foreign companies were putting the principle into practical use and nearly all major oil fields of the world outside of the United States were operated as units and conservation of reservoir energy was an accomplished fact and no longer a theory.

Some of the more progressive executives of oil companies in this country observed these facts and it is interesting to note that in a report of the committee representing the American Institute of Mining Engineers, petroleum division, made at the annual meeting in New York City, February, 1930, approximately 165 projects in the United States and in foreign countries were studied.

Kettleman Hills

One of the outstanding unit operations is the Kettleman Hills area in California. This, in fact, really consists of three agreements covering separately the North, Middle and South Domes. As no discoveries of importance have been made on the Middle or South Dome the results obtained in operating the North Dome are the only ones that can be studied. All agree that it is an excellent example of this type of control and conservation of reservoir energy.

In the Rocky Mountain area the outstanding unit operated field is Salt Creek with over 2,131 wells producing when the agreement was entered into and by this method it is estimated that over $11,650,000 was saved in wells and lifting costs.

Leaders in the Movement

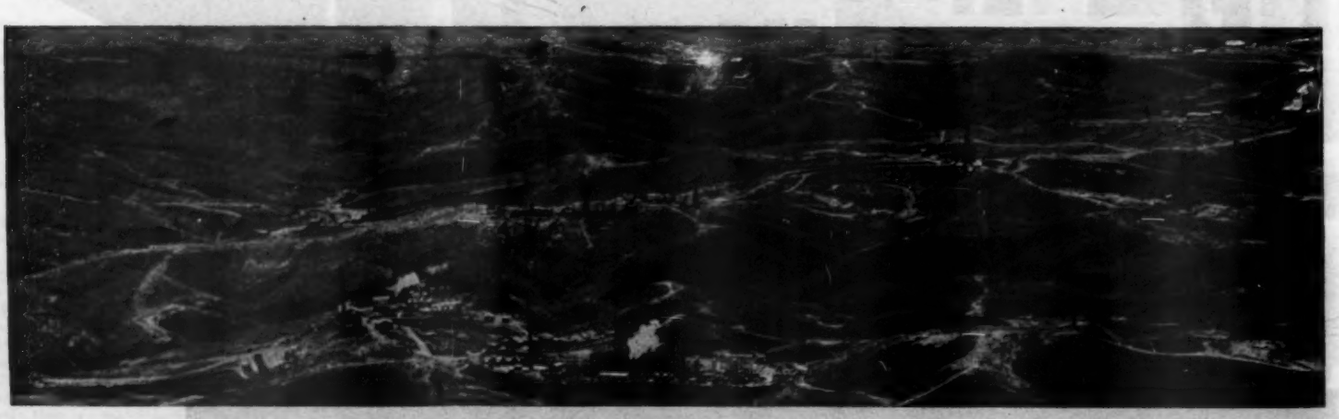
The outstanding work of Earl Oliver, of Ponca City, Okla., in the interest of unit operation will go down in the history of the petroleum industry as an unselfish effort to spread knowledge of the benefits to accrue to the whole industry by the adoption of this general method of conservation. Mr. Oliver served on several committees of national organizations studying unit operation and his extensive writings on the subject are well known to the industry through publication in The Oil and Gas Journal and the transactions of various associations. To aid in the work of formulating plans for the advancement of stabilization in this industry the following individuals have consented to assist Mr. Oliver in this work: Henry M. Bates, Ann Arbor, Mich.; Warner Clark, San Francisco, Calif.; Roy Collom, Ponca City, Okla.; E. L. DeGolyer, New York; Henry L. Doherty, New York; Northcutt Ely, Washington, D. C.; W. S. Farish, New York; C. K. Leith, Madison, Wis.; J. Howard Marshall, Washington, D. C.; Roscoe Pound, Cambridge, Mass.; J. B. Umpleby, Norman, Okla.; W. E. Wrather, Dallas, Tex.

The American Petroleum Institute at its annual meeting held in Chicago in November, 1931, endorsed the principle of equitable and ratable ownership of the recoverable oil and gas in a common pool in its resolution as follows:

"Now, therefore, be it resolved by the board of directors of the American Petroleum Institute, that it endorses, and believes the petroleum industry likewise endorses, the principle that each owner of the surface is entitled only to his equitable and ratable share of the recoverable oil and gas and gas energy in the common pool in the proportion which the recoverable reserves underlying his land bear to the recoverable reserve in the pool."

In the code for the petroleum industry signed September 13, 1933, Article 3, Section 7, reads:

"Wildcatting shall not be prohibited because the future maintenance of the petroleum supply depends on new discoveries and new pools, but the shipment of petroleum or the products thereof in or affecting interstate commerce which was produced in a new field or pool which is not developed in accordance with a plan approved by the President is unfair competition and in violation of this code. For the purpose of this code a new field or pool is one discovered after January 1, 1933, and/or in which not more than 10 producing wells have been completed as of the effective date of this code."



Outstanding Unit Operation North Kettleman Hills, Calif.

Lease Deals and New Locations in Fitts District, Oklahoma, Follow Big Wilcox Sand Wells

By JAMES McINTYRE

The purchase of 695 acres of leases in five sections in the Fitts area in southern Pontotoc County by the Sinclair Prairie Oil Co. and Skelly Oil Co., and four new locations made in the area comprised the most important events in the week's news out of that new field. The Boettcher Oil & Gas Co. of Denver, Colo., was on the selling end of the lease deal above mentioned and the reported purchase price was given as $400,000, half cash and half oil. The price is not official, however.

Four new locations reported Saturday included Bishop Oil Co.'s No. 1 Brydia, SE NE NW Section 25-2-6; Fleetborn Oil Co.'s No. 1 P. A. Norris, NE NE SW Section 25-2-6; Fleetborn Oil Co.'s No. 1 Norris, SE NW NE Section 25-2-6, and Fleetborn Oil Co.'s No. 1 J. Lewis, SE SE SW Section 19-2-7. Three other locations had previously been made. The three big Wilcox sand wells in the pool were all shut in.

In the Edmond area in Oklahoma County, the most interesting drilling well in the State at this time, Mid-Kansas Oil & Gas Co.'s No. 1 Dahl, SE cor. Section 31-14-3w, was deepened an additional 15 feet to 6,502 feet and preparations were being made to take a core. The well was bailed down last mid-week and showed 125 bbls. an hour of oil, with gas at the rate, variously estimated between 50,000,000 and 75,000,000 feet per day.

Some operators in Kansas and Oklahoma, viewing with considerable trepidation the weak refined market and its possible effect on the price of crude are advocating a reduction in crude oil production in the two states. Kansas umpire, T. A. Morgan, made an appeal to the Oklahoma proration department to join in a plan to cut back crude output. Oklahoma umpire, W. J. Armstrong, is quoted as saying that no action to this end can be made this month unless operators agree voluntarily to do so. In Armstrong's opinion the oversupply can be handled in months to come by an allowable reduction if demand is insufficient to justify the allowables fixed by the Government.

The Government's figure on oil production allocations is believed by some authorities to have been too high all summer. They have not given oil purchasers an opportunity to reduce their stocks, already paid for, and which in justice to them they should be permitted to move.

Protest Against Osage Sale

The Osage Oil and Gas Lessees Association has petitioned Secretary of the Interior Ickes not to hold an auction sale of Osage oil leases scheduled for September 18 because there is now an overproduction of oil coming from flush fields in various states, and that such a sale would result in the development of leases in Osage County, which would result in additional overproduction or a greater curtailment per well in the flush fields in that county.

The Corporation Commission has ordered the cancellation of all underproduction of record August 1 in the Wilcox sand zone in the Oklahoma City Field, if such underproduction is not made up by October 1. A potential decline of 50 per cent in the Wilcox zone was declared. Wells of a high gas ratio which have remained shut in to preserve the gas pressure in the field are excepted from the above underproduction order. The minimum well allowable remains at 100 bbls. per day.

Skelly Oil Co. has a big well in the South Burbank Pool, Osage County, in its No. 7 Ducotey, NE NW SW Section 3-25-6. It had Burbank sand at 2,760 feet, with 500,000 feet of gas, first oil at 2,777 feet, total depth 2,832 feet. The well flowed 1,421 bbls. in 12 hours, with 2,000,000 feet of gas.

Sinclair Prairie Oil Co. also added a big producer in its No. 2, SE cor. Section 9-25-6, which flowed 2,975 bbls. in 25 hours from sand at 2,817-48 feet, still in sand.

Midco Oil Corp.'s No. 5 Adlum, NE NW NW Section 10-25-6, flowed 2,202 bbls. in 21½ hours from Burbank sand at 2,675-80 feet, and later it flowed 2,004 bbls. in 24 hours. It was pinched in at both tests. The well has flowed as high as 253 bbls. in one hour. It has a lot of gas, estimated from 8,000,000 to 10,000,000 feet in its initial stage.

Champlin Refining Co.'s No. 3, NW SW SE Section 15-25-6, was shot with 20 quarts at 2,744-64 feet and flowed 150 bbls. the first two hours.

Phillips Pertoleum Co.'s No. 7 Bean, NW cor. Section 15-26-6, is a small well for that area. It was shot three times with small charges and swabbed 20 bbls. in eight hours, but water was coming from behind the pipe at the rate of 2 bailers an hour.

Skelly Oil Co. completed No. 3, SW NW SE Section 16-25-6, in sand at 2,816-34 feet. It tested 293 bbls. in 24 hours, flowing naturally.

Lewis Production Co.'s No. 3, NW cor. SE Section 28-24-7, swabbed 72 bbls. in 24 hours from Bartlesville sand at 2,540-2,652 feet, with oil in the last 42 feet. It had been shot with 60 quarts.

Texas Co.'s No. 7 Taylor, SE SW SE Section 28-23-11, was dry and abandoned at 2,200 feet. It had Hominy at 2,092-97 feet.

H. M. Moshier completed No. 2-A, NW NE NE Section 27-28-10, a 30-bbl. well, after a 140-quart shot at 1,275-1,301 feet.

Wildcat Operations in Oklahoma

Week Ending August 18

NORTHERN OKLAHOMA

ALFALFA COUNTY

Acre et al's No. 1 Acre, C SW NE Sec. 14-24-11w.
T.D. 6,460 ft., lost tools and S.D.

BECKHAM COUNTY

Price and Watchorn O. & G. Co.'s No. 1 Hoard, NE SW Sec. 17-8-26w.
Drlg. 1,964 ft.

CADDO COUNTY

Denver Prod. & Ref. Co.'s No. 1 Noe, NW SW SW Sec. 34-10-10w.
T.D. 11,230 ft.; drill pipe stuck; S.D.

CLEVELAND COUNTY

Anderson & Kerr et al's No. 1 Wilson, NW SE Sec. 27-10-1e.
Rig.

Mid-Continent Pet. Corp. et al's No. 1 Griffin, C E half NE SW Sec. 35-10-1w.
Location.

Phillips Pet. Co. et al's No. 1 Baker, C SE NW Sec. 11-9-2w.
T.D. 7,432 ft., Simpson dolomite; cmtd. off fishing job.

COAL COUNTY

Moore & Deaner's No. 1 Edward, NW NE SE Sec. 27-2-8.
T.D. 4,970 ft.; will deepen.

J. D. Petty Oil Co.'s No. 1 McMillian, SW NW NE Sec. 15-1s-8e.
T.D. 150 ft.; S.D.

GARFIELD COUNTY

Ross Cummings et al's No. 1 Gage, SE NW Sec. 27-22-3w.
Spudded and S.D.

GRADY COUNTY

Western Oil Co., Inc.'s No. 1 Carter, NW NE SE Sec. 32-3-7w.
Wtr. at 3,311-58 ft.; plugging hole.

GRANT COUNTY

Helmerich & Payne's No. 1 Crouse, C NE SW Sec. 29-25-8w.
Rigging up.

W. Earl Witt et al's No. 1 Patton, SW SE Sec. 19-29-3w.
Cellar and pits

HARPER COUNTY

Sinclair Prairie Oil Co.'s No. 1 Neff, NW SE Sec. 21-26-24w.
Drlg. 2,000 ft.

HUGHES COUNTY

J. B. Hill's No. 1-A Perkins, C W½ SW SW Sec. 7-5-9.
T.D. 1,075 ft.; S.D.

Olympic Oil Co.'s No. 1-A McClassen, SE NW NW Sec. 12-9-8.
Cromwell sand 3,433 ft.; T.D. 3,478 ft.; 40,000,000 ft. gas; flowed 309 bbls. in 16 hrs., 1% b.s.; est. 1 bl. wtr. per hr.

Olympic Oil Co.'s No. 1 McClassen, SE NW NW Sec. 12-9-8.
T.D. 600 ft.; lost tools; abd.

Smith et al's No. 1 Farmer, SE NW Sec. 32-5-8.
Drlg. 725 ft.

Turner et al's No. 1 Williams, SW cor. Section 35-7-10
Rig.

KAY COUNTY

Carter Oil Co.'s No. 1 Cline, SE SW SE Sec. 16-28-5.
Dry and abd. 3,267 ft.

KINGFISHER COUNTY

Jadeka Dev. Co.'s No. 1 Frakes, C SW NE SW Sec. 16-15-6w.
T.D. 5,112 ft.; S.D.

LEFLORE COUNTY

East Okla. O. & G. Co.'s No. 1 Metcalf, SW cor. Sec. 2-4-25.
S.D. 1,602 ft. for water.

Leflore Gas & Elec. Co.'s No. 1 James, C W line SE SW SW Sec. 11-6-21e.
Drlg. 450 ft.

Murdock et al's No. 1 fee, SW NE SW Sec. 15-5-25e.
T.D. 2,425 ft.; drlg. by tools.

LINCOLN COUNTY

Mid-Continental Oil Co.'s No. 1 Bolby, C SE SW Sec. 27-12-2.
S.D. 3,280 ft.

L. G. Hulse's No. 1 Sloan, SW NW SE Sec. 19-17-3.
T.D. 885 ft.; S.D.

Texas Co.'s No. 1 Gessmann, SE NE Sec. 32-14-4.
Wilcox 4,900-5,002 ft.; H.F.W.; P.B. and ripped pipe around 3,800 ft.; flow 305 bbls. oil between 8-in. pipe and surface csg.; Cleveland sand 3,040-50 ft.; ripped csg.; est. 10,000,000 ft. gas; flowed 130 bbls. July 28; flowed 75 bbls. July 29; ripped pipe 3,025-31 f..; no show; to shoot off pipe.

LOGAN COUNTY

W. N. Anthony's No. 1 Fruin, SE SW Sec. 4-16-1
Wilcox 5,265-85 ft., T.D.; show gas; S.D.

Gypsy Oil Co. and Sinclair Prairie O. & G. Co.'s No. 1 Manning, C NW NW Sec. 3-17-4w.
Drlg. 3,200 ft.

McCLAIN COUNTY

Benedum & Trees' No. 1 James, SE NW SW Sec. 10-5-3.
Location.

Denver P. & R. Co.'s No. 1 Newburn, C SE SW Sec. 22-5-1.
T.D. 6,355 ft. in Wilcox sand; 1,000 ft. drill pipe lost in hole; dry and abnd.

NOBLE COUNTY

Continental Oil Co.'s No. 1 Bennett, SE NW Sec. 19-20-1w.
T.D. 5,232 ft.; P.B. 5,078 ft.; bailing and cleaning out; small show oil.

Magnolia Pet. Co.'s No. 1 Crawford, SE NW Sec. 27-21-2
Dry and abd. 4,705 ft.

Vaughn Dev. Co.'s No. 1 Loula, NE SE SW Sec. 16-22-1
Layton 3,385-3,430 ft.; drlg. 3,642 ft.

OKFUSKEE COUNTY

Carter Oil Co.'s No. 1 W. H. Dill, C NW SE Sec. 2-11-8
Cromwell sand 3,374-3,408 ft.; flowed 720 bbls. in 24 hrs.; completed.

Delton Oil Co.'s No. 1 Fixico, SE cor. Sec. 7-11-8.
Second Wilcox 4,403-20 ft.. T.D.; D.&A.

OKLAHOMA COUNTY

Springrose Drlg. Co.'s No. 1 Edwards, C SE Sec. 19-11-1.
T.D. 6,540 ft.; 400 ft. drill pipe in hole.
S.D.

OSAGE COUNTY

Peters Pet. Co. and Norbia Oil Co.'s No. 1, SW cor. Sec. 15-25-5.
S.D. 1,712 ft. for wtr.

Empire O. & R. Co.'s No. 1, SE NE Sec. 2-25-3.
Bartlesville sand 2,356-68 ft., broken and dry; chat 3,443-70 ft., dry; Miss. lime, 3,470-80 ft.; Hominy-Wilcox zone 3,810-22 ft.; T.D. 3,824 ft.; 4 bbls. water per hour; P.B. to test Layton and Cleveland sand.

Norbia Oil Co. et al's No. 1, SE NW Sec. 19-25-7.
Rigging up.

(Continued on Next Page)

Indian Territory Illuminating Oil Co.'s No. 1, 300 feet south and 880 feet west of C Section 30-22-9, was a hole full of water in Siliceous lime at 2,741-68 feet. It was plugged back to Layton sand at 1,345-56 feet for a test.

Charles F. Bisett's No. 1, SW SE SE NE Section 11-21-9, was abandoned after Layton sand at 1,134-69 feet was shot and made only a showing of oil. Central Oil Co. made a location for No. 34, SE SW NE Section 34-29-10, and W. C. McBride, Inc., made a location for No. 62, NW SW NE Section 17-23-12.

Estimated Production

Estimated production by pool in Oklahoma for the week ending August 18 and for the preceding week follows:

	Barrels	
	Aug. 18	Aug. 11
Allen	7,695	8,070
Blackwell district	4,900	4,900
Bristow-Slick	10,700	10,700
Cushing-Shamrock	15,000	15,250
Chandler district	7,750	8,000
Davenport	750	750
Healdton	9,300	9,300
Hewitt	6,000	6,000
Burbank	9,300	9,300
South Burbank	9,250	8,000
Balance of Osage	28,500	28,000
Lucien	7,265	7,155
Crescent	3,105	3,090
Marshall-Lovell	1,400	1,400
Bowlegs	12,925	11,180
Carr City	6,870	6,675
Earlsboro	10,875	10,700
East Earlsboro	10,915	9,900
South Earlsboro	875	1,065
Little River	15,190	14,330
East Little River	475	870
Seminole	11,265	12,155
East Seminole	1,215	1,380
Searight	2,245	2,645
Maud	1,175	1,325
Mission	3,405	3,080
St. Louis-Pearson	24,725	25,520
Keokuk	1,985	2,040
Cromwell	4,750	4,775
Papoose	1,300	1,300
Oklahoma City	174,950	195,370
Asher-West Asher	1,315	1,760
Tatums	6,600	6,510
Sholem-Alechem	4,400	4,400
Duncan	4,550	4,550
Tonkawa-Garber-Thomas	6,500	6,500
Fish	3,660	3,860
Konawa	2,260	2,195
Gray	1,990	2,085
Graham	3,750	3,750
Holdenville	3,025	2,960
Wewoka	4,500	4,500
Yale-Jennings	5,300	5,300
Other pools	64,035	65,445
Total	517,240	535,000

Northwestern Wildcats

Carter Oil Co.'s test in Kay County, No. 1 Cline, SE SW SE Section 16-28-5, had dry Bartlesville sand at 3,100-60 feet and chat at 3,227 feet, and was drilled to 3,267 feet. The test was abandoned.

Magnolia Petroleum Co.'s test in Noble County, No. 1 Crawford, C SE SE NW Section 27-21-2e, was abandoned as dry at 4,705 feet. It had first Wilcox sand at 4,660-62 feet and second Wilcox at 4,690-4,705 feet, total depth.

Continental Oil Co. and others' No. 1 Bennett, SE NW Section 19-20-1w, Noble County, a wildcat test, was shut down for orders with the drill pipe out of the hole. It had been drilled to 5,272 feet with no results, then plugged back to 5,074 feet and given a bailing test, with no results.

Lucien Pool

In the Lucien Pool, Noble County, Sinclair Prairie Oil Co.'s No. 2 Bohn, C SW NE Section 29-20-2w, was completed. It flowed 3,009 bbls. in 24 hours. It had first Wilcox sand at 5,001-40 feet and second Wilcox at 5,115-98 feet, both of which were productive.

Shell Petroleum Corp.'s No. 1 Henn-A, C NE NE Section 32-20-2w, was completed. It made a potential flow of 1,036 bbls., with 700,000 feet of gas in 24 hours, after a 40-quart shot in second

Wilcox sand. First Wilcox lay at 4,957-5,010 feet and second at 5,080-5,103 feet.

Creek County

Big Four Petroleum Co.'s No. 2 McIntosh, SE SW SW Section 34-19-8, Creek County, was dry and abandoned at 2,655 feet. It had a showing of oil in Red Fork sand at 2,632-40 feet, but the upper sands showed nothing.

Bert Swift's No. 1 Dean, NE cor. NW Section 18-18-10, drilled to 2,787 feet and plugged back to sand at 1,932-90 feet and shot, made a 10-bbl. well.

C. W. Titus' No. 2 Casey, SE NE SW Section 3-17-8, had Layton sand at 1,310-37 feet. It was shot with 90 quarts and flowed 75 bbls. in 24 hours. It was completed.

Doke & Hughes' No. 4 Watson, NW cor. Section 10-17-8, was shot with 120 quarts in Layton sand at 1,390-1,421 feet and sandy shale at 1,421-25 feet and swabbed and flowed 337 bbls. in 24 hours. It was completed.

Cal Cul Oil Co. abandoned its No. 1 Dawson, SE NE SE Section 18-14-7, at 1,420 feet.

New work in the county included Magnolia Petroleum Co.'s No. 26 Coker, NW SW SW NW Section 16-18-7, in the Cushing Field, ran 5-inch to 2,521 feet preparatory to deepening; W. C. McBride, Inc.'s No. 29 Starr, CNL SE SE NE Section 17-18-7, building rig; L. B. Jackson's No. 5 Brown, SW NW SE Section 27-18-8, drilling at 540 feet.

Tulsa, Okmulgee and Wagoner

R. C. Clemshire's No. 1 Fisher, NE SE SE SE Section 7-19-11, Tulsa County, was dry and abandoned at 700 feet.

Sands Petroleum Co.'s No. 1 Trotter, SE cor. Section 15-18-15, Wagoner County, was dry and abandoned at 1,021 feet, after penetrating sand at 991-1,003 feet. Same company's No. 6 Robbins, C SW SW Section 23-18-15, is a 35-bbl. well after a shot at 1,028-53 feet.

Holderman and others' No. 3 Doyle, C SE SW Section 4-17-14, Leonard district, Tulsa County, was abandoned as dry at 1,546 feet. Sandy lime was penetrated at 1,480-1,500 feet.

Mack Drilling Co.'s No. 9 Richards, CWL NE NE Section 33-16-15, Muskogee County, had sand at 1,457-64 feet, with a showing of oil and a water sand at 1,480-96 feet. The hole was abandoned.

Colton and others' No. 1-A Berryhill, C NW NW Section 20-14-13, Okmulgee County, was dry and abandoned at 2,665 feet. Wilcox sand at 2,656-63 feet filled the hole with water.

Colton and Phillips Petroleum Co. have rig on the ground for No. 1 Unallotted, SE NE NE Section 17-14-12.

Lincoln County

The Misener sand pool opened this year by Blackwell Oil & Gas Co. and others in Township 17-6, Lincoln County, developed a dry hole in Blackwell Oil & Gas Co.'s No. 1 Ladd, SE NE NW Section 23-17-6, which had a hole full of water from Wilcox sand at 3,161-69 feet. No Misener sand was reported in this test. The Comail Oil Co. completed a Misener sand producer in No. 1 Ladd, NE SE NW Section 23-17-6. Sand was found at 3,081-95 feet. It was completed after it had flowed 130 bbls. in 24 hours. Home Gas Co.'s No. 1 Crane heirs, NW SW NE Section 23-17-6, swabbed and flowed 75 bbls. from Misener sand at 3,-095-3,111 feet. It was not completed.

In the Chandler Field in Lincoln County, Magnolia Petroleum Co. completed No. 5 Wagner, SE NW NE Section 18-14-4. It had Wilcox sand at 4,998 feet and drilled 2 feet deeper. The well made 1,275 bbls. in 24 hours with 2,500,000 feet of gas.

Oklahoma County

In the Edmond area in Oklahoma County, Mid-Kansas Oil & Gas Co.'s No. 1 Dahl, SE cor. Section 31-14-3w, got the top of the Wilcox sand at 6,385 feet and drilled to 6,487 feet, still in sand. The well produced gas at the rate of 50,-000,000 feet per day in a three-hour test, in which time it flowed 500 bbls. of oil or at the rate of 4,000 bbls. a day, through two 2-inch chokes.

Gulf Petroleum Corp. of Oklahoma has made a location for No. 1 Lindsay, NE SW NW Section 6-13-3w, and Charles E. Carter and others made a location for No. 1 Suenram, NE cor. Section 7-13-3w.

No completions were reported in the Oklahoma City Field during the week, and no new work was started. Several wells were in Wilcox sand and will make oil wells. Phillips Petroleum Co.'s No. 3 Wallace, 984 feet north and 1,159 feet west of SE cor. Section 22-11-3w, had Wilcox sand at 6,459 feet and drilled to 6,486 feet. It flowed 50 bbls. of oil in one hour with gas at the rate of 7,-000,000 feet per day. Larkin & Warr's No. 1 Travis, 70 feet north and 275 feet west of C Section 22-11-3w, got Wilcox sand at 6,483 feet and drilled to 6,536 feet. It swabbed 65 bbls. in four hours and was shut in. Phillips Petroleum Co. and Shell Petroleum Corp.'s No. 7 Berg, NW SE SW Section 26-11-3w, took a potential and made 310 bbls. in four hours on the gas lift. It was then shut in.

Greater Seminole Field

Carter Oil Co. and others' No. 3 Riddle C-28, S half NW SE Section 35-11-6, Seminole County, flowed 615 bbls. in 24 hours from Misener sand at 4,058-83 feet. The crew ran 2½-inch tubing and treated the sand with 1,000 gallons of acid. Same operators were building rig for No. 1 Stake, C S half NE SW Section 35-11-6.

Carter Oil Co.'s No. 1 W. H. Dill, C NW SE Section 2-11-8, Okfuskee County, flowed 720 bbls. in 24 hours from Cromwell sand at 3,374-3,408 feet. It was completed. Carter Oil Co. made a location for No. 1 E. Welty, C SW NE Section 2-11-8.

Burke Greis Oil Co. made a location for No. 1 Simmer, SW SE SW Section 9-10-11, Okfuskee County.

Atlantic Oil Producing Co. and Gypsy Oil Co. have a rig up for No. 3 Delaware, SE cor. Section 12-9-4, Pottawatomie County.

Mid-Continent Petroleum Corp. completed No. 8 Rentie, SE NE SE Section 14-9-6. It flowed 311 bbls. in 48 hours, following an acid treatment in Hunton lime at 4,025-43 feet. It was drilled deeper to 4,063 feet and reacidized with no increase in production.

Phillips Petroleum Co.'s No. 4 Fixico, NW SW NE Section 26-9-6, an old well plugged back from 4,158 feet, to Hunton lime at 3,960-65 feet, was acidized twice and pumped 182 bbls. gross in 22 hours.

Crofton & Wallace completed No. 1 Houlsee, SW cor. Section 8-9-7, which produced 139 bbls. in 24 hours after an acid treatment in Hunton lime at 4,115-85 feet.

Oklahoma Oil Corp.'s No. 1-A Coody, NW SW SE Section 18-9-7, is a 245-bbl. completion, producing from Hunton lime at 4,051-4,100 feet, which had been acidized.

Olympic Oil Co.'s No. 1-A, 910 feet south and 920 feet east of NW cor. Section 12-9-8, a Cromwell sand test, flowed 309 bbls. in 16 hours, with 1 bbl. of water per hour and 1 per cent b.s. Sand lies at 3,436-78 feet. This well came in in mid-July with 40,000,000 feet of gas and 134 bbls. of oil and has not been completed.

Hodge Drilling Co.'s No. 1 Gregory, NW cor. SW Section 35-8-4, Pottawatomie County, was completed. It has Hunton lime at 4,366-70 feet, which was acidized. The well produced 670 bbls. of oil in 24 hours.

Wrightsman Oil Co.'s No. 1 Commercial Trust Co., SE NE NE Section 28-8-8, was drilled to Wilcox sand at 4,298-4,307 feet, and nothing showing, it was plugged back to Hunton lime at 4,088 feet but the hole filled with water and it was abandoned.

In the South St. Louis area in Pottawatomie County, Jones and others' No. 1 Brandenburg, SW SE Section 3-7-4, swabbed 245 bbls. in 24 hours from Cromwell sand at 3,474-3,508 feet.

Crabtree & Kemp completed No. 1 Gilmore, NW SE NE Section 22-5-8, in Allen sand at 822-40 feet. It was shot with 7 quarts and made a 40-bbl. initial producer.

Erle Halliburton completed his No. 8 Pierson, NW SE NE Section 9-7-4, in Hunton lime at 3,653-3,716 feet, total depth. It was acidized and flowed 168 bbls. in 48 hours.

Champlin Refining Co. has made a location for No. 2 See, CEL NE SE Section 30-7-8, Seminole County; Bryan Petroleum Co. was rigging up No. 1 Greer, NW SE NW Section 35-7-4, Pottawatomie County; E. L. Pegg was rigging up machine for No. 1-A Busby, NW cor. SE Section 20-5-8, Hughes County.

Dry Hole in Grady County

Western Oil, Inc.'s No. 1 Carter, NW NE SE Section 32-3-7w, Grady County, found water at 3,311-58 feet, total depth, and the hole was being plugged.

Pontotoc County

In the Fitts area, Pontotoc County, E. H. Moore and others' No. 2 fee, NE SE SW Section 29-2-7, was shut in after it staged a two-day flow of 1,361 bbls. and 847 bbls., respectively. It had Wilcox sand at 3,951-60 feet; lime at 3,960-68 feet; sand at 3,968-75 feet; lime at 3,975-82 feet, and sand at 3,982-97 feet, total depth.

Crosbie & Moran's No. 2 Hardin, NW SW NE Section 30-2-7, another of the Fitts Pool deep sand producers was also shut in. It started producing from dolomitic sands at 4,180-4,290 feet. This well tested 1,681 bbls. in 11 hours; then 1,461 bbls. in 14 hours. It was choked down to a one-eighth inch and seven-eighths inch chokes and made 343 bbls. in 13 hours; again it flowed 190 bbls. in a single hour through 2-inch tubing.

Shaffer & Delaney's No. 1-A Hardin, NE NW SW Section 30-2-7, flowed through 2½-inch tubing, producing 945 bbls. in five hours. Later it made 1,883 bbls. in 9 hours and 50 minutes. The well is shut in. It shows 850 pounds rock pressure and 50 pounds pressure on the trap.

Southern Fields

In Jefferson County, Farlyn Oil Co.'s No. 21 Seay, 185 feet north and 640 feet west of SE cor. Section 3-7s-5w, is a 40-bbl. completion in sand at 1,226-60 feet.

In Carter County, Schermerhorn Oil Co.'s No. 18 Marcum, 740 feet south and 950 feet east of C Section 3-4s-3w, in the old Healdton Pool, had sands at 889-93 feet, 910-46 feet and 980-82 feet, and

(Continued on Page 332)

Wildcat Operations in Oklahoma

(Continued from Preceding Page)

PITTSBURG COUNTY

Arkhoma's No. 1 Cummings, NW NE SE Sec. 6-4-12.
T.D. 1,490 ft.; fishing.

Exchange Drlg. Co. et al's No. 1 Chunn, SE NW Sec. 29-4-14.
T.D. 850 ft.; waiting for csg.

W. R. Halley's No. 1 Drew, NW SW Sec. 21-3-14.
S.D. 190 ft.

Moffett & Hall's No. 1 Jones, C NE NW Sec. 14-3-14.
Lost tools; T.D. 3,210 ft.; S.D.

PONTOTOC COUNTY

Benedum & Trees' No. 1 James, SE NW SW Sec. 10-5-2.
Moving in rotary.

E. M. Blanchard's No. 1 Crabtree, NE SE NE Sec. 27-2-6.
S.D. 2,920 ft.

Boyle et al's No. 1 Newbern, SW NE Sec. 31-5-4.
T.D. 3,337 ft.; hole full sulphur wtr.; S.D.

Emanuel, Rudman & Hatcher's No. 1 Mayer, SW SE NW Sec. 7-3-8.
S.D. 1,535 ft.

Jarrett Pet. Co.'s No. 1 Johnson, SE NW Sec. 28-4-4.
T.D. 1,269 ft.; S.D. for water.

Dandridge et al's No. 1 Stafford, NW cor. Sec. 5-1-4e.
T.D. 480 ft.; S.D.

Gillette & Kroeger's No. 1 Duver, NW SE Sec. 36-1n-6e.
Drlg. 501 ft.

Riddle et al's No. 1 Barnes, SE NW SE Sec. 21-5-4.
T.D. 2,910 ft.; S.D. for water.

Southern Oil Corp's No. 1 Ladd, C NW NW Sec. 27-3-7.
Cellar.

POTTAWATOMIE COUNTY

W. D. Grisso et al's No. 1-A Kenyon, C NE SE Sec. 3-8-4.
Rig.

Phillips and Gypsy Oil Co. et al's No. 1 Flynn, NE NW Sec. 17-6-3
Dolomite 4,393 ft.; T.D. 4,412 ft.; will run 7-in. csg.

Stanolind-Amerada's No. 1 Goodman, SW NE NE Sec. 5-10-4.
Earlsboro sand 4,405-53 ft., T.D.; swb. and flowed 565 bbls. 21 hrs., est. 10 per cent S.W. and 10 per cent B.S.; to put on pump.

SEMINOLE COUNTY

Harman Oil Co.'s No. 1 Bowlegs, SE NE SW Sec. 1-7-7.
T.D. 1,455 ft.; pulling pipe.

Harris and Haun's No. 1 Harjo, NE SE NW Sec. 11-6-6 (O.W.P.B.).
Old T.D. 2,935 ft.; ripped csg. 2,100-12 ft.; flow 133 bbls.; drlg. by tools 2,139 ft.

Moran et al's No. 1 Brinlee, SW NE Sec. 27-6-6
S.D. for wtr. 1,360 ft.

Tate & Starbuck's No. 1 Heard, SE NW Sec. 9-6-7.
Drlg. 670 ft.

Wrightsman Oil Co.'s No. 1 Smith, NW SE Sec. 25-10-7
Set 6-in. 4,400 ft.; rigging up standard tools.

WASHITA COUNTY

Anadarko Basin Oil Co.'s No. 1 Wolf, NE SW Sec. 23-9-17w.
Rigged up and S.D.

Okla.-Midwestern Oil Co.'s No. 1 Dock, SW cor. Sec. 21-8-18w.
Set 8-in. csg. 2,400 ft.

SOUTHERN OKLAHOMA
ATOKA COUNTY

Brookshire et al's No. 1 Rowland, NW NE NE Sec. 13-3s-10e.
T.D. 3,697 ft.; S.D.

J. D. Boukan's No. 1 Howard, NW SW NW Sec. 19-3s-10e.
S.D. 1,135 ft.; machine moved out.

T. A. Edgerly's No. 1 Donham, SE NW Sec. 35-1-15e.
Rigged up and S.D.

L. A. Fitts' No. 1 Blankenship, NE cor. NW Sec. 15-3s-10e.
T.D. 651 ft.; S.D.

Malernee et al's No. 1 Greenville, N. B. NW SW Sec. 36-2s-13e.
Sand, show oil 3,128-36 ft.; T.D. 3,150 ft.; S.D.

T. C. Ramler et al's No. 1 Roberts, SW SE SW Sec. 6-2s-12e.
Drlg. 738 ft.

CARTER COUNTY

Carter Oil Co.'s No. 1 Bonner, SW SE SE Sec. 19-3s-2w.
Moving in tools.

Daphine Oil Co.'s No. 1 Hooks, SE NW NW SE Sec. 5-1s-2w.
Show oil 1,075-1,185 ft.; T.D. 1,350 ft.; S.D.

Hudson & Poland's No. 1 Sullivan, NE SE Sec. 5-5s-1w.
Sand 3,745-60 ft.; show oil; broken sand 3,840-3,982 ft.; showing oil and gas; set 8¼-in. csg.; drlg. plugs.

McHenry et al's No. 1-A Ratliff, NW SW Sec. 28-1s-2w.
Sand 540-606 ft., T.D.; pumped 7 b ls. in 6¼ hrs.; S.D.

CHOCTAW COUNTY

J. V. Scrivener et al's No. 1 Swink, C NE SE Sec. 29-6s-20e.
Set csg. 410 ft. S.D.

COMANCHE COUNTY

F. F. Stevens' No. 1 Green, SE SW Sec. 2-1-12w.
S.D. 1,210 ft.

Helden & Taylor's No. 2 Crutcher, C NE Sec. 11-1n-12w.
Drlg. 668 ft.

GARVIN COUNTY

National Prod. Co.'s No. 1 Littrell, NE cor. Sec. 31-3n-3w.
S.D. 351 ft.

JACKSON COUNTY

Gypo Oil Co.'s No. 1 Stokes, SE NW SW Sec. 16-1-20w.
Show of gas 872-903 ft.; drlg. 912 ft.

Gypsy Oil Co.'s No. 1-A (Twin) Kelly, NE cor. Sec. 10-1n-20w.
Drlg. 941 ft.

Ben Russell et al's No. 1 Unknown, NW SE Section 30-1-22w.
Drlg. 2,200 ft.

JEFFERSON COUNTY

Geo. Pace et al's No. 1 Jack, NE NW NW Sec. 10-4s-4w.
Gas show 1,510-12 ft. and 1,804-18 ft.; T.D. 1,869 ft.; S.D. for wtr.

JOHNSON COUNTY

Okla. Oil Corp.'s No. 1 Tubbi, NW NE SE Sec. 11-2s-8.
At 2,061 ft. est. 1,000,000 ft. gas; 3,150 ft., H.F.W.; Hunton lime 2,445 ft.; drlg. 2,757 ft. in Sylvan shale.

MARSHALL COUNTY

Nunn and Stinnett's No. 1 Lindecker, NW cor. Section 7-8s-6e.
S.D. 610 ft.

Paul Robb's No. 1 Vittetoe, C NE SE Sec. 11-5s-4e.
T.D. 4,937 ft.; S.D. for wtr.

MURRAY COUNTY

Ed. Galt et al's No. 1 Aetna Life Ins. Co., SE NW NW NW Sec. 14-2s-3e.
T.D. 485 ft.; S.D.

Gilcrease Oil Co.'s No. 1 Brown, SW cor. Sec. 26-1n-2e.
Sand (Wilcox?) 1,724-38 ft.; T.D. 1,743 ft.; fishing.

T. E. Rowell et al's No. 1 Wolfe, NE cor. Sec. 18-1-2.
S.D. 2,600 ft.

STEPHENS COUNTY

Carter Oil Co.'s No. 1 McCasland, C NW NW SW Sec. 32-1s-4w.
Moving in tools.

J. W. Madison's No. 1 Tussey, SW SE NW Sec. 24-1s-4w.
S.D. 3,220 ft.

TILLMAN COUNTY

J. H. Everett's No. 1 Crane, SW cor. Sec. 15-3s-14w.
Rig.

HISTORY

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Barber County, Kansas, Test Swabs 225 Barrels of Oil in 12 Hours, But With Much Water

By JAMES McINTYRE

Another county in Kansas has been added to those producing oil. It is Barber County, just north of Alfalfa County in Oklahoma. The Lario Oil & Gas Co., drilling the wildest of wildcats, No. 1 Whalen, C NW Section 32-31-11w, a little northeast of the city of Medicine Lodge, found the top of the Mississippi lime at 4,355 feet a couple of weeks ago and drilled to 4,435 feet, but into an ocean of water along with an oil production.

The hole was plugged back to 4,395 feet and a swabbing test brought up 225 bbls. of oil and 425 bbls. of water in 12 hours. It was again plugged back to 4,380 feet, but no test had been made at that total depth when the last report on the well was filed.

The great distance of the production from any other oil pool makes this a most interesting discovery, and whatever the fate of the Lario well (for there appears to be danger of the water drowning out the oil), it will mean further exploration in that county. The Lario well is the most southwesterly oil well in the State, although there is oil production farther to the west in counties in the northern part of the State. It is producing from chat.

In Sumner County, Wakefield and the Lario Oil & Gas Co. abandoned No. 1-A McCullough, SW NW SE Section 14-33 4w. It had been drilled to the base of the Siliceous lime at 3,524 feet, where it had a hole full of water and was plugged back to 3,085 feet, but tested only a small showing of oil.

Roth & Faurot's No. 1 Fox, SE cor SW Section 35-30-7, Cowley County, was abandoned as dry at 2,858 feet. It had no showings. Bartlesville sand was penetrated at 2,693-2,700 feet.

Sedgwick County

In Sedgwick County, E. B. Shawver and others' No. 1 Russell, SE cor. Section 17-28-1e, flowed an average of 661 bbls. a day for three days, following an acid treatment in Mississippi lime at 3,064-3,101 feet. It was completed.

Phillips Petroleum Co.'s No. 2 Nolan, SW NW NW Section 21-28-1e, flowed an average of 644 bbls. per day for three day from Mississippi lime at 3,064-3,104 feet and was completed. It had not been acidized.

Magnolia Petroleum Co.'s No. 9 W. K. H. Trust, NE SE NE Section 19-27-2e, pumped 264 bbls. in 24 hours from chat at 2,937 feet drilled into only 2 feet. It was completed. Same company had cellar dug for No. 3 H. Vickers, NW SW NW Section 20-27-2e.

Corbett & Evans were running 10-inch to 1,000 feet in their No. 1-A Boling, CEL NE NW SW Section 6-26-1e. Lassen & Bruce were running 10-inch pipe to 928 feet in No. 1-A Baylor (a twin), CSL SW NW NW Section 6-26-1e, and Paul White, trustee, had a rig up for No. 2-B Gorman, CSL NW NW SW Section 6-26-1e.

Butler County

In the old Towanda Pool in Butler County, Gypsy Oil Co.'s No. 23 Orban, SE NE NW Section 11-26-4, was completed in Kansas City lime at 1,952-91 feet. It pumped 14 bbls. in 31 hours.

H. Garden and others' No. 1-A Crowley, CSL SE NE SW Section 14-28-5e, was completed. It pumped 52 bbls. in 24 hours from Kansas City lime at 2,096-2,112 feet, which had been acidized.

Vickers Petroleum Co.'s No. 1-A Joseph, NE cor. Section 36-24-3e, had Mississippi lime at 2,644 feet and pay at 2,650-54 feet, total depth. It pumped 232 bbls. of oil and 60 bbls. of water in 24 hours and was completed.

Greenwood County

In Greenwood County, Cory Oil Co.'s No. 1 Holland, C N half SW SW Section 10-25-11, was abandoned as dry at 1,715 feet, after penetrating Bartlesville sand at 1,681-99 feet.

Kingman County

In Kingman County, Skelly Oil Co.'s No. 4 North Miles, 440 feet from south and 440 feet from west line of SE Section 19-27-10w, was acidized in Kansas City lime at 3,423-3,505 feet and flowed 98 bbls. in 15 hours.

Estimated Production

Estimated daily average production of Kansas in the week ending August 18 and in the preceding week follows:

	Barrels	
	Aug. 18	Aug. 11
Hollow	9,790	8,260
Ritz-Canton	13,450	14,465
Voshell	6,225	7,750
Johnson	1,987	1,912
Sedgwick County	7,935	7,335
Nikkell	6,330	6,050
Ellsworth County	3,471	3,560
Barton County	1,615	1,517
Rice County	14,510	13,365
Reno County	5,702	5,545
Ellis County	769	464
Kingman County	1,669	1,445
Stafford County	1,750	1,246
Russell County	7,630	7,425
Greenwood County	12,250	12,400
Butler County	20,000	20,100
Other pools	19,387	16,486
Total	134,630	129,325

Reno County

Washoma Oil & Gas Co.'s No. 1 Crotts, NE NW NE Section 27-26-10w, Reno County, was abandoned at 266 feet. It had been shut down over 18 months.

Stanolind Oil & Gas Co. and Amerada Petroleum Corp. completed No. 1 Holtje-C, NE NW SW Section 16-26-4w, Reno County, which had shown a potential of 429 bbls. in 24 hours on the pump, from Viola lime at 4,056-58 feet.

In the Burrton Pool, Barnsdall Oil Co.'s No. 3 Sabin-B, C NE Section 11-23-4w, found chat at 3,255-3,333 feet, where it made 8,500,000 feet of gas. It was drilled to 3,376 feet and was making 10,000,000 feet of gas and a spray of oil. It was shut in for orders.

Same company's No. 4 Sabine-B, NE NW NE Section 11-23-4w, swabbed 410 bbls. in six hours from Hunton lime at 3,599 feet, total depth 3,609 feet. No production was found in the chat topped at 3,261 feet. Location was made for No. 5 Sabine-B, NW NE NE Section 11-23-4w.

Olson Oil Co. and Shell Petroleum Corp.'s No. 2 Duckworth, NE NE NE Section 23-23-4w, was shut down for orders after showing an 8,000,000-foot gas production at 3,290-3,300 feet. Same operators were rigging up No. 3 Krehbeil, C NW NE Section 26-23-4w, and have rig up for No. 2 Querfeld.

Barnsdall Oil Co. and Indian Territory Illuminating Oil Co.'s No. 1-C Baughman, NE cor. Section 34-23-4w, was completed. It pumped 1,384 bbls. in 24 hours from Hunton lime at 3,587-95 feet which had not been acidized.

Harvey County

Sinclair Prairie Oil Co.'s No. 3 Ediger, NE SE SW Section 19-22-3w, Hollow Pool, Harvey County, pumped 65 bbls. in four hours from Wilcox sand at 3,491-3,535 feet.

Stanolind Oil & Gas Co. and Amerada Petroleum Corp.'s No. 4 Froese, NW cor. Section 20-22-3w, an old well deepened to 3,505 feet, pumped 692 bbls. in 24 hours and was completed.

McPherson County

Shell Petroleum Corp.'s No. 2 Keohn, NW SE NE Section 16-21-3w, Voshell Pool, McPherson County, swabbed 127 bbls. in 13 hours from Wilcox sand at 3,398-3,414 feet and was being rigged up to pump. It had been shot with 20 quarts.

Derby Oil Co. and others' No. 5 Domsch, SW NW NW Section 6-20-1w, Ritz Pool, which had been acidized in Viola lime at 3,401-13 feet, pumped 266 bbls. in 24 hours on a potential test and was completed.

Regina Oil & Gas Co. completed No. 1 Young, C SW SW Section 9-20-1w, Ritz Pool, producing from Viola lime at 3,404-12 feet which had been acidized, flowed fluid which was 12 per cent water, but it made 334 bbls. of net oil in 24 hours and was completed.

Carey and others' No. 1 Bullinger, C NE NE Section 17-20-1w, pumped 60 bbls. in five hours from acidized Viola lime at 3,393-98 feet.

Roth & Faurot's No. 1 Swanson, NE SW NE Section 13-19-3w, an old well deepened from 2,961 feet, found a pay at 3,007-10 feet and flowed 250 bbls. in 24 hours. It was held for potential test.

Olson Oil Co. and Shell Petroleum Corp. completed No. 1 Russell, C SE SE Section 3-19-2w, Ritz Pool. It had been deepened from 2,956 feet to 3,410 feet, but found water at 3,409 feet and was plugged back to 2,958 feet and completed as a 2,000,000-foot gas well.

Breslin Oil Co.'s No. 2 Flock, SE NE SW Section 35-19-2w, an old well deepened from 2,947 feet to Wilcox sand at 3,404-12 feet, was a hole full of water and was abandoned.

Shell Petroleum Corp. was building rig for No. 2 Hull, CSL SE SE SW Section 11-19-2w, and made a location for No. 7 Griffin-A, CNL NE NE NW Section 14-19-2w.

Rice County

Slick-Urschel, Inc.'s No. 1 Rick, SE cor. Section 17-20-10w, Raymond Pool, Rice County, pumped 329 bbls. in 24 hours from acidized Kansas City lime at 3,045-96 feet. Tom Palmer and Atlantic Oil Producing Co.'s No. 2 Specht, SW cor. Section 16-20-1w, was at the cellar stage. Empire Oil & Refining Co. made a location for No. 1 Specht, NE cor. Section 20-20-10w. The Texas Co. was spudding No. 5 West, SE NW NW Section 21-20-10w. Vickers Petroleum Corp. made a location for No. 4 Binger, SW NW SE Section 21-20-10w.

Continental Oil Co.'s No. 2 Foote, NW SE Section 7-20-9w, Sharpe Pool, had Siliceous lime at 3,255-92 feet. It swabbed 192 bbls. in 15 hours and pumped 407 bbls. in 12 hours and was then acidized.

Sinclair Prairie Oil Co.'s No. 1 Sharpe, SE NW NE Section 7-20-9w, took a potential test and pumped 86 bbls. in 24 hours from acidized Siliceous lime at 3,255-3,325 feet.

Rush County

Mid-Kansas Oil & Gas Co.'s No. 1 J. B. Mohr, C NW Section 10-18-16w, Rush County, was completed. It flowed 153 bbls. of oil and 12,600,000 feet of gas from Siliceous lime at 3,527-36 feet. This was the first oil well in this area which is known for its gas production. The Texas Co., Skelly Oil Co. and others are offsetting the well with No. 1 Mohr, C NE Section 15-18-16w, and have set 15-inch pipe at 385 feet.

Barton County

Atlantic Oil Producing Co.'s No. 1 Straub, C SE NW Section 36-18-11w, Barton County, which had been acidized in Siliceous lime at 3,286-3,310 feet, pumped 45 bbls. of oil and 15 bbls. of water in 24 hours.

Ellsworth County

Eldorado Refining Co. and others' No. 9 Stratman, SW NW SE Section 1-17-10w, in Ellsworth County, swabbed 100 bbls. in 14 hours from Siliceous lime at 3,257-62 feet, total depth.

Stanolind Oil & Gas Co. and Gypsy Oil

(Continued on Page 344)

Wildcat Operations in Kansas

Week Ending August 18

(Descriptions are East unless marked otherwise)

BARBER COUNTY

Indian Territory Illuminating Oil Co.'s No. 1 George, C SE SW Sec. 12-32-10w
Mississippi lime 4,394 ft.; drlg. 4,470 ft.

Lario O. & G. Co.'s No. 1 Whelan, C NW Sec. 32-31-11w
Chat 4,355-4,435 ft.; P.B. to 4,395 ft.; swbd. 225 bbls. oil and 400 bbls. wtr.; P.B. to 4,380 ft.

BARTON COUNTY

Atlantic O. P. Co.'s No. 1 Straub, C SE NW Sec. 36-18-11w.
Siliceous 3,286-3,313 ft., T.D.; P.B. to 3,310 ft.; acidized; pumped 45 bbls. oil and 15 bbls. wtr. in 24 hrs.

Gypsy Oil Co. and Atlantic Prod. Co. and Shell Pet. Corp.'s No. 1 Batchman, C SW NE Section 18-20-12w.
Drlg. 1,085 ft.

Harris & Haun and J. Brook's No. 1 Dietz, NE SW Sec. 21-16-15w.
Drlg. 2,855 ft.

Murphin and Downing's No. 1 Lanterman, NW SE Sec. 15-19-11w.
Building rig.

National Ref. Co.'s No. 1 Ingersoll, C NW NE Sec. 2-19-13w.
Drlg. 2,175 ft.

Walter Shearon et al's No. 1 Kempler, SE NE NE Sec. 31-18-11w.
S.D. 300 ft.

BUTLER COUNTY

F. H. Unruh et al's No. 1-A Joseph, SE SW NW Sec. 18-25-4e.
Location.

CLAY COUNTY

Seidel Bros.' No. 1 Youkers, C S½ SE NW Sec. 21-9-4.
T.D. 1,200 ft.

COWLEY COUNTY

National Refining Co.'s No. 1 Robinson, NE SE NE Section 11-34-4.
T.D. 1,895 ft.; fishing.

Otstot et al's No. 1 Eckhardt, SE NW Sec. 15-35-6.
Spudded and S.D. for wtr.

Roth & Faurot's No. 1 Fox, SE SW Sec. 35-30-7.
Bartlesville sand 2,693-2,700 ft.; dry; T.D. 2,858 ft.; abd.

Wakefield et al's No. 1 Weigle, NW SE SE Sec. 6-32-6.
Rig.

DICKINSON COUNTY

Dutch Oil Co.'s No. 1 Phillips, C NE NW Sec. 15-15-1e.
T.D. 2,300 ft.; U.R. 8-in. csg.

ELLIS COUNTY

Ashby et al's No. 1 Mermis, NW cor. NE Sec. 34-13-16w
Spudded and S.D.

ELLSWORTH COUNTY

Elwell et al's No. 1 Campbell, SW cor. Sec. 20-17-7w
Drlg. 1,950 ft.

GREENWOOD COUNTY

Greeley et al's No. 1 Satler, SW SE SW Sec. 28-25-12.
S.D. 335 ft.

HARPER COUNTY

R. G. Berry's No. 1 Anthony, C SW SW Sec. 17-31-9w.
8-in. 4,516 ft.; T.D. 4,521 ft.; R.U. standard tools.

HARVEY COUNTY

Hollow et al's No. 1 Summerfelt, NW NE NW Sec. 3-22-1w.
Drlg. 2,530 ft.

(Continued on Page 332)

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Among Gulf Coast Drilling Contractors

Bathing suits and surf fishing tackle promise to become standard equipment among Gulf Coast supply men when E. R. Kirkpatrick, drilling contractor, starts rigging up on Galveston Island to drill a well for R. E. Sedberry and others in the near future. Location is between a 1,400-foot hole drilled back in 1902 by parties now unknown, and a well drilled to 4,615 feet by Magnolia Petroleum Co. in 1924. Prospect presumed to be related to the Rattlesnake Mound geophysically located dome discovered by H. C. Cockburn.

Al Buchanan has a contract to drill No. 1 T. J. Graham, George Reynolds Survey, Duval County, for the Texas Co.

East Texas Drilling Co. is moving in rig to drill a well for Woodley Petroleum Co. in Tyler County, about 2 miles south of Woodville. Location is on a 259-acre lease in the John Wheat Survey.

Carl B. King is preparing to drill a new location in East Texas for the Dyck Oil Co.

DeArman Brothers Drilling Co. is preparing to drill a well on its own property in Waller County. Location is 150 feet southeast from southeast line, 150 feet from southwest line, 242 feet south of corner of Downman & Bains 100-acre tract, John McFarland Survey.

Jeff Hooper, having just completed a well for the American Liberty Oil Co. in the Coleto Creek Field, Victoria County, is now preparing to drill another well for the same company in the same field, and also to drill a well for himself and Rupert Cox on the J. Zimmer 125 acres, Coleto Creek Field. Hooper is shut down on a well for the Shell Petroleum Corp. at Danbury waiting for water, delivery of which was interrupted this week when a well drilled by the Shell corporation in the same field blew out.

Jess Fowler, who recently completed a well for the Allied Minerals Corp. at Boling Dome, has contract to drill a second well on the company's acreage in this field.

W. Claud Smith is completing a well for the Texas Co. in the Tomball Field.

Smith & McDannald have seven rigs running at this time. One rig is moving to new location at Cayuga for Tide Water-Texas Seaboard companies. Four rigs are running for the Superior Oil Co. at Bosco, La., one on the Kahn lease, one on the Leonard Savoie lease, one on the Forrester lease and one of the Larcade lease. A sixth rig is running for the Tide Water Oil Co. in East Texas, and a seventh is drilling for the Pure Oil Co. at Louise.

George Echols has added two new locations during the week, one for the Circle W Oil Co. at Pettus, and one for the Jeffries Oil Co. near Sejita, Jim Hogg County. The latter is a wildcat.

Turnbull & Irwin are moving in a rig to drill No. 1 Braden in the SE Section 50, about 4 miles southeast of Juliff, Brazoria County. The company has abandoned its Jefferson County wildcat.

Al Buchanan and the Blanco Oil Co. have closed a deal with the United Production Co. for the north 100 acres of the SE Section 9, West Tuleta, Bee County, the northwest corner of which is a half mile south of the discovery gas well and a test will be drilled at once. This will give an idea of the field in that direction and disclose whether or not it is a dome-shaped proposition with the discovery gas well at the apex.

WATER CARRIER CODE

A proposed code of fair competition for inland water petroleum carrier industry in the eastern division of the United States has been submitted by a committee claiming to represent 100 per cent of that industry. A public hearing will be conducted Wednesday, August 22, at 10 a.m., at the Mayflower Hotel, Washington, D. C., under Deputy Administrator J. B. Weaver. The proposed code provides that within 60 days after its effective date, the code authority shall prepare and submit to the administrator a schedule of hours of labor and working conditions for vessel employes. The industry covers the transportation of bulk petroleum products by water.

G. S. King (left) geologist for the Sun Oil Co., assigned to duty on the company's wildcat 9 miles from San Diego, in Duval County, Tex. W. A. Brandhorst, (right) driller and field superintendent for George Echols, drilling contractor. Ed Green, (center) member of the drilling crew, is heading for the fiesta at San Diego—or somewhere. Mr. Brandhorst started his oil field career as a roughneck for C. G. (Curt) Hammill in 1916 in the Markham Field. He became a driller in 1921 while working for the Texas Co. in the West Columbia Field. Later he worked for the Humble Oil & Refining Co. and the Sun Oil Co. In 1925 he became a driller for George Echols in the Luling Field, and has been associated with Mr. Echols since that year. In the 9½ years he has drilled for Mr. Echols he has never lost a well, and has only twisted off once, a record of which he is proud.

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Danbury May Be Added to Deep Salt Domes; First Fair Oil Producer at Coleto Creek

By A. C. EASTERWOOD
Gulf Coast Bureau, The Oil and Gas Journal

HOUSTON, Tex., Aug. 20.—That Danbury, central Brazoria County, is to be added to the list of deep producing salt domes on the Gulf Coast was fairly definitely proved the past week when Shell Petroleum Corp.'s No. 3 Haury blew out from a sand around 6,290 feet. It blew for five hours before the gas could be killed. After connections were installed and the well shut in the pressure ran up to 1,540 pounds. Production was estimated at 25,000,000 feet of gas daily.

Bottom of the hole is in the Marginulina zone, the basal Marine Oligocene horizon prolific at such fields as Manvel, Iowa and others, which has given indications of important and consistent pay at a number of additional deeply seated geophysically discovered domes and structures developed in recent years. Just previous to the blowout in the Danbury well, operators had taken a core at 6,284-86 feet and were preparing to go back in the hole for another.

Plans of the company call for deepening the hole in exploration of possible oil production. To complete the well as it is would necessitate the running of casing as the blowout was through open hole. The casing now consists of a string of 13⅜-inch surface pipe.

The well is in the H.T.&B. Survey No. 13, and is the most southeasterly test in the area, being 800 feet southeast of No. 2 Haury, abandoned in salt at 6,271 feet, which in turn was 720 feet south and east of No. 1 Blakely-Winston, the first test drilled, which had salt at 5,228-55 feet. The latter, drilled in 1929 and 1930 was plugged back to a shallow sand around 1,600 feet, where it made a small well. It never was commercially productive but was pumped for several months this year to supply fuel, being abandoned in July. A total of nine tests, including the present, have been drilled on the dome. All have encountered numerous sands showing oil and gas. Four of the tests have been deep, going below 5,000 feet. Shell Petroleum Corp. controls the entire dome.

Coleto Creek

The first oil producer of any size for the Coleto Creek (Raisin) Field of western Victoria County, in the lower Gulf Coast district, also was completed during the week. This was American Liberty Oil Co.'s No. 1 A. Prybil, R. Manchola Survey. From a sand at 2,796-2,801 feet, it came in flowing between 350 and 400 bbls. daily. The oil tested 22.4 gravity at 84 degrees. It has been shut in for storage.

Development of Coleto Creek, going on since early in 1933, has been more or less disappointing. Production has been largely gas with some distillate recovery although several wells have made small amounts of oil. A total of 10 tests have been completed, four dry holes. Salt water has given considerable trouble. Numerous sands have been encountered in all the wells although production so far is only from a 2,200, 2,800 and 4,400-foot sand.

The American Liberty producer is the most northwesterly well. Another oil producer, Nutex Oil Co.'s No. 1 Zimmer, was completed during the week but made only 30 bbls. initial flow through a quarter-inch choke. Pressure on the tubing was 225 pounds while that on the casing was 350 pounds. The latter well is the first well in the 2,200-foot sand being completed with bottom at 2,209 feet. It is between the American Liberty producer and the field.

Refugio County

The Bonnie View area, in Refugio County, was being watched for possible new production. Heard-Holland Oil Co. was trying to make a well in its No. 1 Peck from a Frio sand. Bottom of the hole is 5,351 feet and 7⅝-inch casing is seated at 5,348 feet. The well was swabbed down 3,500 feet where a pressure of 250 pounds was shown on the casing. It then was swabbed to 4,000 feet but there was no pressure. Late in the week preparations were being made to jam the well with air.

Two additional wells, the second and third, are nearing the horizon found productive in the new field opened late last year by Quintana Oil Co. on Quintana and Humble Oil & Refining Co.'s joint block 3 miles southeast of the Greta Field, and about 9 miles northeast of Refugio. The discovery well, Quintana Oil Co.'s No. 1 O'Connor, J. M. Swisher Survey No. 3, was completed in sand at 5,569-75 feet as good for 26 bbls. an hour on a three-eighths inch choke. The two wells drilling are No. 2-A D. M. O'Connor, 400 feet north and 450 feet west of the discovery and No. 1-B O'Connor, 6½ miles south of the producer in the B.B.&B. Survey. Both are drilling around 5,000 feet. While the latter is pretty far away and a failure would not hurt the area much, the other well will throw additional light on the possibilities.

Brazoria County

The Pledger Field, Brazoria County, was cut off to the south by the failure of Danciger Oil & Refining Co.'s No. 1 Stark-Brown, Perry & Austin Survey, abandoned as dry at a total depth of 6,935 feet. It is about a mile from the discovery, a wet gasser. Of particular interest is the location made by Humble Oil & Refining Co. for a deep test between 7,000 and 8,000 feet southeast of the area proved on the Danciger block. The location is on the Bob McFarland tract in the D. McNeil Survey, and is 525 feet south and 1,900 feet west of the southeast corner of the W. C. Carson Survey. Humble has drilled a couple of deep dry holes west of the Danciger block in Matagorda County so the test on the southeast will have an important bearing on trends. So far production at Pledger has been confined to a few high pressure wet gas wells from a 6,900-foot horizon in the Marginulina zone of the Marine Oligocene.

Harris County

At Mykawa, Harris County, southeast of Houston, Danciger Oil & Refining Co.'s No. 1 Minnetex, J. Lovett Survey, blew out early in the week and ran wild for a day and a half before bridging. Production was estimated from 50,000,000 to 75,000,000 feet daily with some sources rating the well at 100,000,000 feet. After the blowout, the derrick and rig were pulled off preparatory to efforts of operators to kill it. Because of the condition of the hole the well has been junked, plugged and abandoned. Bottom of the hole is 4,005 feet. A similar blowout occurred at Mykawa a couple of years ago in a well drilled by Crown-Framer Oil Co.

Louise Field

Pure Oil Co. late in the week had set screen in its No. 2 Kountze, a mile southeast of production at its Louise Field to test a sand showing oil at 5,120-55 feet. Northwest of the field, Pure Oil Co. abandoned its No. 1 Stidhan, Morris & Cummings Survey No. 23 as dry at 5,218 feet. Location has been made for a test northeast of the field, No. 1 Adams, T. W. Heard Survey, Section 26. One other well, No. 2 Stewart, in Section 25, located in the proven area, is drilling.

Galveston County

Pure Oil Co. is rigging up on the Dickinson (San Leon) geophysical prospect in Galveston County. This test, No. 1 Shelor, is approximately 1,500 feet north of Humble Oil & Refining Co.'s No. 1 Maco Stewart, the wildcat which recently blew out at a total depth of 7,916 feet from a sand reported topped at 7,889 feet. The latter well, which caught fire and destroyed the derrick and rig, has been abandoned temporarily. So far Humble has not definitely selected its second location, such a location will be made right away and another rig has been provided for it. Humble also has a number of lease expirations coming up soon which may force additional activity, which as a result of the blowout is looked upon as proven.

Polk County

At Livingston, Polk County, a Conroe trend field, J. C. Werby and Shell Petroleum Corp. got a small well in No. 2

Wildcat Operations on Gulf Coast

Week Ending August 18

RACCOON BEND—AUSTIN COUNTY

Humble O. & R. Co.'s No. 7-X Gotosky, 466 ft. N and E lines of 150-ac. tract in W. C. White Sur.
Drlg. shale 5,875 ft.

Humble O. & R. Co.'s No. 7 Sherrod, W. C. White Sur.
Drlg. shale 3,650 ft.

Humble O. & R. Co.'s No. 14 Roy Thompson, 466 ft. S of N line, 933 ft. E of W line of 353-ac. tract in W. C. White Sur.
T.D. 4,158 ft.; comp. 36 bbls. per hour.

Humble O. & R. Co.'s No. 15 Thompson.
Spudded.

Humble O. & R. Co.'s No. 2 Urban.
Drlg. shale 5,266 ft.

Humble O. & R. Co.'s No. 1 E. B. Jolke.
Rig.

Humble O. & R. Co.'s No. 2 E. B. Jolke.
Drlg. shale 2,004 ft.
A.C.H.&B. Sur. No. 9 at C of Lot 22.

DANBURY—BRAZORIA COUNTY

Shell Pet. Corp.'s No. 3 Haury, 800 ft. SE of No. 2 in line with No. 2 and No. 1 Blakely-Winston, H.&T.B. Sur. No. 13.
T.D. 6,290 ft.; blew out while going in to core; killed gas estimated 25,000,000 ft. daily; S.I. pressure 1,540 lbs.; waiting orders.

Shell Pet. Corp.'s No. 1-A Schmitt, 357 ft. E and 107 ft. from NW cor. of 146-ac. tract in J. H. Bruner Sur.
Coring sand 2,080 ft.

DAMON MOUND—BRAZORIA COUNTY

Exco's No. 1-D Wisdom, 25 ft. from S and W lines of Blk. D, Lot 5, A. Darst Sur.
lime and shale 1,165 ft.; S.D.

H. Wisdom's No. 1 Proctor, 40 ft. out of SW cor., Blk. 1, A. Darst Sur.
Set screen 1,620 ft.

MANVEL—BRAZORIA COUNTY

Gulf Prod. Co.'s No. 2 Colby, 991 ft. SE and 330 ft. NE of W cor. of Colby lease, Lot 21, T. Sproggins Sur.
Drlg. sand rock 4,386 ft.

Harrison & Abercrombie's No. 1 Bernard River Land, 1,000 ft. out of SE cor. of Lot 22.
Drlg. hard sandy lime 4,231 ft.

Max O. Milner's No. 1 H. F. Stipp, 330 ft. W of E line and 195 ft. N of S line of Lot 28, H.&T.B. No. 23 Sur.
Location.

Texas Co.'s No. 12-B Belcher, 194 ft. and 42 degrees 330 ft. N 48 degrees W from NE cor. of Helen J. Way lease in H. N. Little Sur.
Drlg. sandy shale 4,009 ft.

Texas Co.'s No. 1 Del Bell, 330 ft. E and 330 ft. S of NW cor. of Lot 11, Charles O'Donnell Sur.
Drlg. gumbo 1,358 ft.

Texas Co.'s No. 3 Houston Oil Field Assn., 247.5 ft. S, no deg. 38 ft. W and 419.4 ft. N 89 deg. 32 ft. W from NE cor. of Lot No. 16, A.C.H.&B. Sur. No. 91.
Sand 3,981-99 ft.; comp. 700 bbls. daily, ¼-in. choke, T.P. 320 lbs., corrected gravity 24.9 deg.

Texas Co.'s No. 5 Houston Oil Field Assn., A.C.H.&B. Sur. No. 9 at C of Lot 22.
Moving in rig.

Texas Co.'s No. 2 Lieder, 646 ft. N, 330 ft. W of SE cor. of Lot No. 1, A.C.H.&B. Sur. No. 91.
Drlg. sand and lime 3,947 ft.

Texas Co.'s No. 1-A Massey, 330 ft. out of NW cor. of 33-ac. tract in H. Stevens Sur.
Drlg. shale and lime 4,659 ft.

Texas Co.'s No. 1 Rash, 330 ft. S, 42 deg. W, and 330 ft. S, 48 deg. E, from NW cor. of lease in Thos. Sproggins Sur. No. A-366.
Drlg. lime rock 1,794 ft.

PLEDGER—BRAZORIA COUNTY

Humble O. & R. Co.'s No. 1 Bob McFarland, 525 ft. S, 1,900 ft. W of SE cor. W. C. Carson Sur.
Location.

STRATTON RIDGE—BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 1 Bowers, 2,400 ft. N line and 1,550 ft. from E line of Jared Groce Sur.
Drlg. shale 1,650 ft.

WEST COLUMBIA—BRAZORIA COUNTY

Miramar Oil Corp.'s No. 3 Hogg, 100 ft. N of No. 2 and 100 ft. from W line of lease.
No report; former T.D. 5,394 ft.

Texas Co.'s No. 34 Hogg, 2,483 ft. N, 50 ft. W from SE cor. of lease in M. Varner Sur.
T.D. 5,053 ft.; reaming to set 9⅝-in. csg.

BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Prod. Co.'s No. 5-A Wilburn, 350 ft. W of No. 4, C of lease, Henry Griffith Sur.
R.U. to work over.

Mills Bennett Prod. Co.'s No. 10 Wilburn, 190 ft. S N line, 150 ft. W of No. 9, Henry Griffith league.
Rigging up.

Humble O. & R. Co.'s No. 6-B Kirby, 593 ft. N of S line, 388 ft. E of W line of lease or 125 ft. N and 288 ft. W of No. 5.
Set 2 joints 5-in. O.D. screen 4,880 ft.

Humble O. & R. Co.'s No. 7-B Kirby, 200 ft. W of No. 6 in Henry Griffith league.
Bldg. derrick.

McAlbert Oil Co.'s No. 6 Woodward, C 5-ac. tract, W. H. Hodges Sur., 400 ft. W of No. 5.
Workover; drlg. shale 3,682 ft.

Moody Corp.'s No. 5-A E. W. Barber, 100 ft E of W line and 70 ft. N of S line of lease.
T.D. 4,545 ft.; reaming to set 5-in. screen and liner.

Moody Corp.'s No. 6-A Barber, 75 ft. W of E line and 400 ft. N of S line of lease.
Sand S.O. 4,172 ft.

Sinclair Prairie Oil Co.'s No. 18-A Wilburn Henry Griffith league, 150 ft. W of No 17-A and 14 ft. S N line of lease.
Cutting and pulling screen to deepen 4,347 ft.

Sun Oil Co.'s No. 6 Higgins, 302 ft. W of E line and 422 ft. N of S line of lease.
Drlg. cap rock 1,004 ft.

Sun Oil Co.'s No. 10 Higgins, 50 ft. from N and W lines of lease.
Drlg. shale 1,074 ft.

Sun Oil Co.'s No. 17 Wilburn fee, 188 ft. E of W line and 40 deg. S of N line and 120 ft. W of No. 16.
Derrick.

Sun Oil Co.'s No. 22 J. Wilburn, midway between wells No. 17 and 21, or 150 ft. from each well.
T.D. 1,350 ft., cap rock; cmtd. hole to 1,125 ft.

Texas Co.'s No. 7 Wilburn, 116 ft. S of Humphrey's No. 8-H Kirby, in Henry Griffith league.
T.D. 4,939 ft.; 5-in. csg. 4,830 ft.; swabbing 54 bbls. net oil, 12 per cent B.S.&W.

Texas Gulf Prod. Co.'s No. 2 Eberspacher, 480 ft. from S line and center of strip No. 4.
Salt 2,411 ft.; top salt 1,373 ft.

Texas Gulf Prod. Co.'s No. 3 O. W. Winfree, 595 ft. S of N line and 50 ft. W of E line of lease.
Rig.

(Continued on Page 319)

Dick & Failing, north of the field. This well, in sand with bottom in the Cockfield at 4,334 feet, flowed 12 bbls. in the first four hours through an eighth-inch choke with 1,340 pounds pressure on tubing and 1,620 pounds on casing. Location has been made on the same 160-acre tract for a third well, 330 feet from the south line and 330 feet from the west line. T. D. Humphries' No. 1 P. E. Orton, also north of the field, tested salt water at 4,338 feet and was abandoned.

Raccoon Bend

The sixth Cockfield sand producer for the Raccoon Bend Field, Austin County, which until the recent play has produced only from the Hockleyensis zone of the Jackson, was completed the past week in Humble Oil & Refining Co.'s No. 14 Thompson. It came in flowing 34 bbls. an hour from a total depth of 4,158 feet. It has been estimated that 100 wells will be drilled in the Cockfield at Raccoon Bend before this play ends.

Tomball Field

The Tomball Field in northern Harris County added two wells with the completion of Humble Oil & Refining Co.'s No. 1 Otis F. Laird, C. N. Pillott Survey, and No. 1 Kleb, J. House Survey. The former, in Cockfield sand at 5,555-66 feet, flowed 456 bbls. and 1,017,000 feet of gas through a quarter-inch choke with pressure of 1,500 pounds on tubing. The other made a gasser, gauging 1,512,-000 feet through a quarter-inch choke, with 1,500 pounds on tubing and casing.

Texas Co.'s No. 3 Houston Oil Field Association, Lot 16, A.C.H.&B. Survey No. 91, east extension area of the Manvel Field, Brazoria County, flowed at the rate of 699 bbls. of oil through a quarter-inch choke from the Miocene pay with bottom at 3,999 feet. It gauged a pressure of 320 pounds on the tubing and is a good well.

SOUTH LOUISIANA

In the Choctaw Field of Iberville Parish, Louisiana, Standard Oil Co. of Louisiana got a good well in No. 6 Myrtle Grove, Section 52-9s-11e, which flowed 890 bbls. initially from sand at 4,414 feet. At Sulphur, Calcasieu Parish, Union Sulphur Co. completed two wells, Nos. 776 fee and 797 fee, the former flowing 500 bbls. at 4,770 feet and the other 650 bbls. at 3,788 feet. Its No. 796 fee was abandoned at 2,288 feet in salt. At Black Bayou, Shell Petroleum Corp.'s No. 19 Watkins, Black Bayou, Cameron Parish, flowed 18 bbls. an hour through an eighteenth-sixty-fourths inch choke from sand at 3,897 feet. It had 250 pounds pressure on tubing and 310 pounds on casing.

At Bosco, Acadia Parish, Superior Oil Producing Co. has abandoned as dry its No. 1 Sidney Arceneaux, three-quarters of a mile northwest of the discovery (No. 1 Hermandes). Drilled to a total depth of 8,771 feet, it fairly definitely limits the field. No. 1, a mile southwest of the discovery, also is being abandoned at a total depth of 7,745 feet. While the hole is being quit because of stuck drill pipe, the test is reported to have run 300 feet low, virtually cutting off the field. The area now is limited to the north, west, southwest and northeast. The northeast limit is by No. 1 Marcellus Savoie, which although still drilling, is down 8,861 feet, or 1,011 feet below the producing depth of the discovery. It also got salt water in sand at 8,203-15 feet. It is a mile from the discovery. To the southeast, however, a distance of approximately three-quarters of a mile from the discovery, No. 1 Looanstie Richard, has found a deep sand at a total depth of 8,718 feet and is reaming to set casing at 8,706 feet to test.

Roanoke District

The coming week should place Shell Petroleum Corp.'s No. 1 Jernigan, east offset to the company's No. 1 Kratzer, discovery well of Roanoke, Jefferson Davis Parish, in the pay horizon, in which the latter well was completed at 8,682 feet. The Jernigan test has been running approximately the same. Humble Oil & Refining Co.'s No. 1 Kratzer, approximately a half mile southwest of Shell's discovery well, is drilling below 7,300 feet, while the company's No. 3 DeVilbiss, three-quarters of a mile southwest, is down 8,220 feet.

At Welsh, also in Jefferson Davis Parish, Tide Water Oil Co.'s No. 1 Bourgeois, south of the old shallow Welsh Field and the first important test in exploration of deep production around that field, after plugging back from 6,107 feet to 5,050 feet is preparing to sidetrack in new hole to a sand around 5,400 feet in which a favorable oil showing was passed up.

Texas Co.'s No. 11 Garden Island Bay, at the mouth of the Mississippi River, the most southerly point of Louisiana, is shut in after completion as a 60,000,-000-foot gasser, made through a half-inch choke from the cap rock at 1,672 feet. This is the first well successfully completed on this dome. Previous wells have encountered heavy gas pressures and development has been marked by quite a few blowouts.

Chambers County

Turnbull & Irwin have abandoned No. 1 Sudindorf, H.&T.C. Survey, Section 67, east of Anahuac, Chambers County, Texas. The well went to a total depth of 7,937 feet, where it had water sand. With an elevation of 21 feet, the Discorbis was topped in this test at 6,370 feet, the Heterostegina at 6,810 feet and the Frio at 7,607 feet. Although there has been little to correlate with, it has been calculated this test ran 150 to 200 feet high.

Tyler County

Boone, Wallace & Lane have abandoned No. 1 Crude, S. L. Graham Survey, Tyler County, a Conroe "trend" test, dry at 3,025 feet. It topped the Cockfield at 1,961-65 feet, elevation 150 feet.

Woodley Petroleum Co. and Jaybee Oil Co. are starting another Conroe trend test in Tyler County, No. 1 Glenn Lawrence (Acton Young), 330 feet from the north and west lines of the 259-acre tract in the J. Wheat Survey. This is 2 miles south of Woodville. A rig is up.

Waller County

DeArman Brothers Drilling Co. has made location for a wildcat on a block in Waller County, No. 1 Bain-Downman, 150 feet from the southeast and southwest lines of the 100-acre tract in the John McFarland Survey. It is 7 miles northwest of Brookshire.

Austin County

Indian Territory Illuminating Oil Co. and Johnson Brothers' No. 1 August Wrangler, wildcat in the Adam Kuykendall Survey, New Ulm district, Austin County, is reported to have topped the Hockleyensis at 2,940 feet with an elevation of 368 feet. This is believed to place the test a little high. At latest report it was drilling shale below 3,602 feet.

Cleveland Area

At Cleveland, northwestern Liberty County, Gulf Production Co.'s No. 5-C Kirby topped the Hockleyensis at 4,723 feet with an elevation of 130 feet. This test, 933 feet west and 500 feet south of No. 4-C Kirby, is 28 feet higher on the basis of those figures. No. 4-C topped the Hockleyensis at 4,761 feet with an elevation of 140 feet. The present test is the sixth drilled in the Cleveland area, in which there now are three producing wells.

Wharton County

Texas Gulf Producing Co.'s No. 1 Kresta, W. B. Ivey Survey, near El Campo, Wharton County, got the Discorbis at 4,355 feet with an elevation of 107 feet. This is running a little higher than the first test. It is at a total depth of 4,401 feet in shale. Royalty is bringing a base price of from $50 to $60 an acre.

Van Vleck Area

Skelly Oil Co.'s No. 1 Cobb, discovery well of the Van Vleck area, northern Matagorda County, was placed on production the past week after having been shut in since its completion in March.

(Continued on Page 332)

SHAFFER

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TULSA, OKLAHOMA

California Development Still in Upward Trend; Wildcat Work Going Steadily Forward

By L. P. STOCKMAN
Staff Correspondent, California Fields

LOS ANGELES, Calif., Aug. 20.—With the second half of the current year well under way and development work still on the upward trend, it appears quite probable that drilling operations during 1934 will be substantially in excess of last year which showed a decided improvement over 1932. Exploration work in wildcat areas is holding up in good shape and indications point to a continuance of drilling operations in prospective territory during the next several months. Up in Fresno County, the Western Gulf is building rig for a new wildcat to be drilled about a mile east of its first test in Section 15-17-15 which proved to be a duster at 8,868 feet. The latter looked rather promising during the course of work, despite the failure to get production, and the proximity of the new location tends to indicate that officials of the company are of the opinion that the original hole may possibly have been an edge well.

In the Buena Vista Lake region of Kern County, the Ohio Oil Co. is believed to have opened up a new commercial gas field but this will not be determined until another well or two have been drilled. The company's initial test in this section, located at the extreme eastern end of the Buena Vista Lake, produced at the rate of about 20,000,000 feet of gas per day for about a week before being shut in. The Ohio is expected to undertake additional drilling in this area within the next few months. The Milham Exploration Co.'s wildcat in San Joaquin County was recently abandoned as a duster, but the company is already preparing to start work on another test in the immediate locality.

The Amerada Petroleum Corp. has staked location for a deep test to be drilled at Blackwells Corner on the Beer property in Section 17-25-19, and an early spud is contemplated. In McFarland district, Home Corp. is expected to have rig material on ground within the next 15 days for a wildcat to be drilled in Section 16-26-27. The Tejon Ridge Oil Co. is making rather slow time with its test in the Commanche Point district but will probably step up drilling within the next week. In the Tulare Lake region the Trico Oil & Gas Co. is rigging up its No. 2 and this project should begin making hole within the next few days. The company's first test on this property, which was drilled in Section 33-24-22, has been suspended at 3,715 feet. The second project is being drilled in Section 3-25-23.

Up in Madera County the Pure Oil Co. has reached a depth of 5,860 feet in a wildcat being drilled in the vicinity of Chowchilla in Section 7-10-14, but nothing of interest has been logged up to the present. Out in the McKittrick front, the Standard is redrilling its deep test which showed possibilities of commercial gas production several weeks ago but it will be another few weeks before the company reaches bottom and begins making new hole. The Standard is drilling this outpost in search of oil and will consequently drill ahead before giving the well a chance to show its gas potentialities. The Everett Drilling Co. is expected to begin drilling operations on a new test in the Camp Kearney district of San Diego County in the near future and this work will be watched with interest in view of what appear to be live seepages and a well defined structure.

Union Oil Co.'s wildcat in the Fullerton Heights district of Los Angeles County does not look any too hot and it is quite probable that the hole will be abandoned in the near future unless some favorable showings are logged within the next few hundred feet of hole. The company's test on the Moretti property in the Santa Maria district has been standing suspended for the past week following a rather unsuccessful production test but it is the present intention to re-enter the hole and ascertain just why it has proved so erratic. Rancho Oils, Inc., is rigging up rotary drilling equipment for a test in Section 18-5-23 in Ventura County and spud is expected to be made within the next few days. This company has leased about 2,000 acres of prospective oil land located about 3 miles west of Ojai and approximately 9 miles north of the Ventura Avenue Field. The acreage lies west of the Ventura River and south of Baldwin Road, extending to Santa Ana Creek. Production is expected to be developed at about 2,000 feet.

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Interconstal-domestic—						
Fuel oil	254,382	36,340	.....	.....	5,868,692	805,661
Diesel and gas oil	.....	.....	.....	.....	1,000,056	1,935,064
Gasoline	196,575	28,082	361,423	51,632	4,584,387	5,848,453
Kerosene	.....	.....	.....	.....	648,080	502,970
Asphalt	.....	.....	.....	.....	70,019	12,179
Other finished oil	.....	.....	.....	.....	54,778	63,210
Other unfinished oil	.....	.....	.....	.....	.....	72,584
Foreign exports—						
Crude oil	151,622	21,660	338,359	48,337	4,660,527	4,277,752
Fuel oil	421,412	60,202	81,846	11,692	7,589,204	4,762,432
Diesel and gas oil	101,383	14,340	47,024	6,718	2,687,300	2,183,478
Gasoline	.....	.....	89,163	12,738	2,428,969	3,581,507
Kerosene	.....	.....	28,780	4,111	1,168,991	1,104,821
Other finished oil	.....	.....	.....	.....	3,529	12,086
Other unfinished oil	.....	.....	.....	.....	186,069	34,547
Coastwise-domestic—						
Crude oil	220,317	31,474	62,174	8,882	5,207,918	4,355,869
Fuel oil	50,660	7,237	341,419	48,774	5,346,349	5,911,287
Diesel and gas oil	1,519	217	32,219	4,603	424,560	890,394
Gasoline	419,225	59,889	277,360	39,623	7,098,273	7,885,294
Kerosene	2,925	418	7,015	1,002	97,173	119,886
Naphtha distillates	.....	.....	.....	.....	.....	27,651

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic—						
Fuel oil	.....	.....	.....	.....	110,650	.....
Diesel and gas oil	.....	.....	.....	.....	448,113	280,531
Gasoline	73,179	10,454	.....	.....	218,985	702,977
Kerosene	.....	.....	.....	.....	276,412	482,430
Lubricants	.....	.....	.....	.....	26,500	24,366
Foreign exports—						
Crude oil	75,601	10,800	.....	.....	1,080,673	1,224,818
Fuel oil	78,928	11,275	25,371	3,624	1,171,641	466,775
Diesel and gas oil	61,411	8,773	.....	.....	879,681	539,898
Gasoline	147,172	21,025	.....	.....	2,026,215	2,759,094
Kerosene	120,555	17,222	.....	.....	630,644	578,878
Lubricants	18,836	2,691	.....	.....	108,580	76,905
Other finished oil	.....	.....	.....	.....	2,760	3,745
Other unfinished oil	.....	.....	.....	.....	5,750	26,278
Coastwise-domestic—						
Fuel oil	267,047	38,150	191,036	27,291	3,374,767	2,077,838
Diesel and gas oil	5,783	826	.....	.....	105,912	164,162
Gasoline	379,997	54,285	88,019	12,574	2,830,540	2,489,245
Kerosene	7,341	1,049	.....	.....	64,805	78,246

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well, location—	S.T.R.	Depth	Status—
Clayton, G. L., No. 1 Cerritos, Los Angeles Co.	31- 3-12	6,701	hd. sh. drilling
Woodward Oil Co., No. 1 Athens, Los Angeles Co.	12- 3-14	5,231	sd. sh. drilling
Houser, G. W., No. 1 Athens, Los Angeles Co.	18- 3-12	4,037	cleaning out
Quinn, J. B., No. 1 Dominguez, Los Angeles Co.	3- 4-13	4,587	plug 4,290
Nudson, T. T., No. 1 Inglewood, Los Angeles Co.	17- 2-14	3,020	pg. 2,370, idle
East Santa Fe Oil Co., No. 1 Inglewood, Los Angeles Co.	16- 2-14	mtl.	bldg. rig
Morton Oil Co., No. 1 Inglewood, Los Angeles Co.	7- 2-14	6,060	pump 10 b.d.
Scientia Oil Co., No. 1 Inglewood, Los Angeles Co.	7- 2-14	3,086	plug 3,375
Pacific Western, No. 1 Inglewood Deep, Los Angeles Co.	8- 2-14	5,057	cemented
Plymouth Oil Co., No. 1 Ingelwood, Los Angeles Co.	8- 2-14	5,602	pg. 4,450, idle
Wilshire Oil Co., No. 2 Potrero Deep, Los Angeles Co.	27- 2-14	7,861	cemented
Fouri, C. W., No. 1 Del Rey, Los Angeles Co.	27- 2-15	....	material
Community Oil Co., No. 1 Montebello, Los Angeles Co.	34- 1-11	7,447	suspended
Texas Co., No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	6,993	looks wet
Standard Oil Co., No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	7,203	gr. sd. drilling
St. Helens, No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	5,851	sd. sh. drilling
Fullerton Oil Co., No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	5,953	hd. sh. drilling
Pressel & Tull, No. 1 Puente Hills, Los Angeles Co.	30- 2- 9	3,281	br. sh. drilling
Barstow Oil Co., No. 2 Saugus, Los Angeles Co.	35- 5-16	731	gr. sd. drilling
International Dev. Co., No. 1 Saugus, Los Angeles Co.	34- 5-16	2,795	hd. sd. drilling
Black Eagle Oil Co., No. 1 Huntington, Orange Co.	tideland	3,985	suspended
Explorers Drlg. Co., No. 1 Fairview, Orange Co.	9- 6-10	945	reaming
Nuoli Co., No. 1 Newport, Orange Co.	29- 6-10	6,470	br. sh. drilling
B. & B. Oil Co., No. 1 Newport, Orange Co.	19- 6-10	mtl.	bldg. rig
Platt & Collins, No. 1 Costa Mesa, Orange Co.	14- 6-10	3,153	hd. sh. drilling
Mid-Rich Drlg. Co., No. 1 Atwood, Orange Co.	26- 3- 9	3,041	br. sh. drilling
Union Oil Co., No. 1 Coyote, Orange Co.	22- 3-10	5,672	sd. sh. drilling
Bridger, J., No. 1 Coyote, Orange Co.	15- 3-10	5,065	sd. sh. drilling
Severns Drlg. Co., No. 3 West Coyote, Orange Co.	24- 3-11	5,474	O.S. cemented
Rubens, Si, No. 2 East Coyote, Orange Co.	19- 3- 9	rig	rigging up
Great American Pet., No. 1 Chino, San Bernardino Co.	18- 2- 8	2,642	suspended
Great American Pet., No. 2 Chino, San Bernardino Co.	18- 2- 8	3,100	sidetrack d.p.
Great American Pet., No. 3 Chino, San Bernardino Co.	7- 2- 8	rig	rigging up
Tehama Pet., No. 1 Santa Ana Canyon, San Bernardino	33- 2- 8	2,226	cleaning out
San Diego Pet. Co., No. 1 Chula Vista, San Diego Co.	32-18- 2	4,304	sd. sh. drilling
San Diego Drlg. Co., No. 1 Camp Kearny, San Diego Co.	29-15- 3	....	location

Suspense Account

Umpire Pemberton has requested a clarification of an apparent misunderstanding regarding the creation of a suspense account covering excess production chalked up by California operators and the release of lease stocks as of September 8, 1933. Mr. Pemberton's letter addressed to the writer is to the effect that "several oil producers have called my attention to a portion of your article in the August 9 issue of The Oil and Gas Journal regarding excess production. Going back to September 8, 1933, the petroleum administrator ruled that all oil in storage on that date was frozen. Now, if on June 23, 1934, all production in excess of allotments is suspended and at the same time all crude in storage as of September 8, 1933, is released, the only way to effect that order would be to suspend all excess production as of June 23, 1934, and allow the producer to sell all that he had in his tanks on June 23, 1934. In that way we would be releasing all storage oil as of September 8, 1933.

"The General Order No. 8, calling for the release of oil in storage as of July 1, 1934, rather than June 23, 1934, has involved in it the following matters: Allowable production from June 23 to June 31 is of course permissible for shipment. Excess production during that eight-day period would be deducted from July allowable. Therefore, stocks as of July 1, 1934, would be subject to shipment, based upon the compilation which would be made into July allowables." This order has the effect of releasing for shipment all oil in storage on leases as of June 23, 1934, instead of September 8, 1933, as the order promulgated by the petroleum administrator specified. It is quite obvious of course that the situation is rather complicated in as much as lease stocks as of September 8, 1933, may not be available. Purchasers of crude oil have in many cases refused to take the entire amount of crude oil eligible for shipment under the order but will take the remaining balance over a period of two or three months.

Allocation Revision

The Central Committee of California Oil Producers at a special meeting this week decided to change the method of allocation in the Fruitvale and Santa Fe Springs Fields from the graduated method to a method which is based on a minimum allotment and a straight percentage of the potential. The Complaints and Grievance Committee reported to the Central Committee that "upon the evidence and record submitted, we find that the strict application of the graduated method of intrafield allocation does not constitute a fair measure of the relative ultimate productivity as between existing wells of varying potential in the aforesaid two fields. The committee finds further that in both fields wide differences in the density of development as between different properties coupled with the geological and physical conditions in said fields as shown by the record and evidence hereinbefore referred to, will have the effect under a strict application of graduated allocation within said fields to diminish unduly the ultimate productivity of wells of large potential for the benefit of the wells of small potential. The committee expressly disclaims any intention to give weight to undrilled acreage as such except in so far as extreme differences in the density of development of the different properties provide for less densely drilled properties a wider drainage area, which sustain the higher potentials, so as to render graduated curtailment inequitable as a measure of the ultimate productivity of existing wells in said fields." The change in the method of allocations in these two fields is the result of protests, supported by ample data, by the Western Gulf Oil Co. and the Union Oil Co. both of which proved that the graduated method of allocation was inequitable in the fields in question.

Edison Area

The Edison area of Kern County will soon become California's hot spot if oper-

ators continue the present rate of development. Right now, based on the results of drilling and the showings logged in several wells, the Edison Field will extend over an area of several square miles. Production is secured at a relatively shallow depth and although the gravity of oil produced places it in the fuel oil class rapidly increasing prices of fuel oil seem to jusify the present intensive development.

The A. T. Jergins Trust made a preliminary production test of No. 1 Daugherty in the Edison area, in Section 14-30-29, and it showed a potentiality of 75 bbls. of 16.5 gravity oil per day from 1,198 feet. The well has not yet been completed. On the Hay property, the Jergins interests found the Vedder zone dry at 3,561-3,630 feet and the hole was accordingly drilled down to the Walker zone at 3,759 feet. The productivity of this horizon has not yet been determined. The Barnsdall picked up the top of the schist in No. 1 Slininger at 2,382 feet and the company is making preparations to test out the oil sand above this formation. The Edison area has attracted operators more than any other area opened up during the past few years and consequently leasing activities are rather brisk.

Mount Poso

Superior Judge Lambert at Bakersfield has denied the demurrer interposed by the Bern Oil Co. against a suit filed by the Pacific Western Oil Co. for $75,000 damages charging whipstocking methods of drilling beneath properties of the Pacific Western Oil Co. In denying the demurrer, Judge Lambert stated that "the lease of the plaintiff gives the plaintiff exclusive right to drill for and remove oil from the land. The plaintiffs are entitled to an injunction against the trespasser entering land with no right to land covered by plaintiff's lease." As a result of this decision the suit will go to trial in the immediate future. The outcome of the case will prove of considerable importance to California operators as it should determine the rights of operators holding land which is being drained because of wells which have been deviated from the vertical for the specific purpose of intercepting the oil zone under another's properties. The suit of the Pacific Western against the Bern Oil Co. is based on crooked hole drilling in the Mount Poso Field of Kern County.

Shell Oil Co. completed No. 8 Security pumping 665 bbls. of clean 16.6 gravity oil per day from 1,796 feet. Another well of the Shell, No. 8 Vedder, is standing cemented on top of the pay and should be completed within the next several days.

Elwood

The Barnsdall-Rio Grande interests finished No. 9-B on tideland permit No. 88 in the Elwood Field of Santa Barbara County. It flowed 350 bbls. of 35.4 gravity oil per day, cutting 15 per cent, from 3,342 feet after the hole had been plugged back from 3,417 feet. No. 8 Doty, the Barnsdall's deep Sespe test, is rotating ahead at 5,740 feet in what appears to be a rather good looking oil sand. The Honolulu Oil Co.'s No. 8 on tideland permit No. 90 is pumping 200 bbls. per day from 3,420 feet, but the output is cutting about 40 per cent. In the Santa Barbara Mesa Field of Santa Barbara County, C. L. Ross has finished his No. 1 Ballantyne doing 302 bbls. of clean 17.6 gravity oil per day from 2,107 feet after completing the hole with a 5-inch liner carrying 45 feet of perforated. In the Santa Maria district the Union Oil Co. finished No. 14 California Coast pumping 130 bbls. of 17.1 gravity oil per day from 3,966

(Continued on Page 332)

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well, location—	S.T.R.	Depth	Status—
General Pet., No. 9 Capitan, Santa Barbara Co.	32- 5-30	3,061	cemented
Shell Oil Co., No. 3 Capitan, Santa Barbara Co.	32- 5-30	1,898	sd. sh. drilling
Petroleum Sec., No. 1 Los Alamos, Santa Barbara Co.	6- 7-32	1,582	sd. sh. drilling
Royalty Ser. Corp., No. 1 Los Alamos, Santa Barbara Co.	35- 9-32	191	sd. sh. drilling
Fairview Oil Co., No. 1 Purisima, Santa Barbara Co.	18- 7-34	2,981	fishing d.p.
Barnsdall-Rio Grande, No. 8 Doty Elwood, Santa Barbara	15- 4-29	5,735	O. S. drilling
East Elwood Pet. Co., No. 1 Elwood, Santa Barbara Co.	14- 4-29	3,197	hd. sh. drilling
Shell Oil Co., No. 1 Goleta, Santa Barbara Co.	20- 4-28	2,386	hd. sh. drilling
Standard Oil Co., No. 2 Goleta, Santa Barbara Co.	17- 4-28	4,689	hd. sh. drilling
Cuyama Valley Oil Co., No. 1 Cuyma, Santa Barbara Co.	12-10-27	4,196	hd. sd. drilling
Woodrow Pet., No. 1 Rincon, Ventura Co.	4- 3-24	7,612	redrlg. 5,412
Continental, No. 3 San Miguelito, Ventura Co.	23- 3-24	6,524	O. S. drilling
Texas Co., No. 128 South Mountain, Ventura Co.	4- 3-19	2,085	O. S. cemented
Oil Ridge Oil Co., No. 1 Fillmore, Ventura Co.	1- 4-19	1,068	hole caving
Bolsa Chica Oil Co., No. 1 Piru, Ventura Co.	4- 4-18	2,498	will deepen
Piru Oil Co., No. 1 Piru, Ventura Co.	14- 4-18	961	sd. sh. drilling
Pac. Dev. Co., No. 1 Santa Susana, Ventura Co.	12- 2-18	rig	rigging up
Williamson & Donaher, No. 1 Simi, Ventura Co.	36- 3-18	1,016	suspended
American Drlg. Co., No. 1 Simi, Ventura Co.	6- 2-17	711	sd. sh. drilling
Macrate, A. N., No. 1 Ojai, Ventura Co.	27- 4-23	5,405	O. S. drilling
Prop. Service Corp., No. 1 Lloyd, Ventura Co.	24- 3-23	5,695	sd. sh. drilling
Kirk, W. A., No. 1 Sulphur Mountain, Ventura Co.	21- 4-22	2,220	br. sh. drilling
Mosher, J. W., No. 1 Santa Paula, Ventura Co.	22- 4-21	2,253	br. sh. drilling
Las Posas Pet., No. 1 Las Posas, Ventura Co.	22- 3-20	7,370	will deepen
International Oil Developers, No. 1 Conejo, Ventura Co.	33- 2-20	3,068	suspended
Standard Oil Co., No. 1 McKittrick, Kern Co.	15-30-22	3,653	redrlg. 3,440
Casa Mira Oil Co., No. 1 Belridge, Kern Co.	29-28-20	5,365	hd. sd. drilling
General Pet., No. 1 South Belridge, Kern Co.	30-28-21	11,377	temp. suspend.
Union Oil Co., No. 13 North Belridge, Kern Co.	36-27-20	8,166	hd. sd. drilling
Standard Oil Co., No. 1 North Belridge, Kern Co.	36-27-20	4,528	redrlg. 3,045
Associated Oil Co., No. 1 Lost Hills, Kern Co.	2-26-20	7,858	plug 6,850 tst.
Home Corp., No. 1 McFarland, Kern Co.	16-26-27	....	location
Ohio Oil Co., No. 1 McVan, Kern Co.	22-27-27	....	location
Mountain View Dev. Co., No. 1 Mountain View, Kern Co.	12-30-28	4,250	suspended
Gilmore Oil Co., No. 1 Mountain View, Kern Co.	24-30-28	5,857	suspended
Amerada Pet. Co., No. 1 Blackwells Corner, Kern Co.	17-26-19	....	location
Union Oil Co., No. 3 Mountain View, Kern Co.	15-30-28	5,250	repair rig
Texas Co., No. 1 Mountain View, Kern Co.	14-30-28	mtl.	bldg. rig
General Pet., No. 1 Mountain View, Kern Co.	14-30-28	4,981	sd. sh. drilling
Barnsdall, No. 2 Mountain View, Kern Co.	32-30-29	4,732	sd. sh. drilling
Hogan Pet., No. 5 Mountain View, Kern Co.	32-30-29	5,582	sd. sh. drilling
Standard Oil Co., No. 1 Mountain View, Kern Co.	19-30-29	5,630	95 b.d.
Hoyt, Otis, No. 1 Mountain View, Kern Co.	19-30-29	5,165	O. S. drilling
Shell Oil Co., No. 1 Mountain View, Kern Co.	30-30-29	4,000	sd. sh. drilling
Gilco, Inc., No. 2 Edison, Kern Co.	23-30-29	mtl.	bldg. rig.
Monterey Exploration, No. 2 Edison, Kern Co.	22-30-29	2,445	formation wet
Jergins Trust, No. 1 Edison, Kern Co.	23-30-29	3,759	sd. sh. drilling
Jergins Trust, No. 2 Edison, Kern Co.	14-30-29	1,190	cemented
Shell Oil Co., No. 1 Edison, Kern Co.	16-30-29	2,518	formation test
Shell Oil Co., No. 2 Edison, Kern Co.	15-30-29	1,940	cemented
Barnsdall, No. 1 Edison, Kern Co.	26-30-29	2,415	schist-cmtd.
Centralia Oil Co., No. 1 Edison, Kern Co.	26-30-29	2,198	O.S. cemented
Ohio Oil Co., No. 1 Edison, Kern Co.	36-30-29	1,031	sd. sh. drilling
Commanche Oil Co., No. 1 Commanche, Kern Co.	15-32-29	4,326	suspended
Tejon Ridge Oil Co., No. 1 Commanche, Kern Co.	23-32-29	615	sd. sh. drilling
Russ Oil Synd., No. 1 Kingsburg, Fresno Co.	28-12-11	4,004	suspended
Bergman, Harry, No. 1 Kingsburg, Fresno Co.	12-12-11	6,138	suspended
Union Oil Co., No. 1 Lillis-Kettleman, Fresno Co.	24-21-16	10,944	redrilling
Western Gulf, No. 2 S. P., Fresno Co.	11-17-16	mtl.	bldg. rig
Farrel Pet., well No. 1, San Luis Obispo Co.	18-31-12	1,091	sd. sh. drilling
Willett Oil Co., No. 2 Cholame, San Luis Obispo Co.	10-25-15	2,202	sd. sh. drilling
Commonwealth Consd. Gas Co., No. 1 Tulare Lake, Kings	21-22-20	1,950	hd. sd. drilling
Commonwealth Consd. Gas Co., No. 2 Tulare Lake, Kings	21-22-20	rig	portable outfit
Armadillo Oil Co., No. 1 Tulare Lake, Kings Co.	32-22-20	1,760	suspended
Kettleman Pac. Oil Co., No. 1 Tulare Lake, Kings Co.	11-23-16	805	sd. sh. drilling
Weller, Carl, No. 1 Tulare Lake, Kings Co.	11-23-16	820	sd. sh. drilling
Mastadon Oil Co., No. 1 Tulare Lake, Kings Co.	27-24-23	rig	suspended
Trico O. & G. Co., No. 1 Atwell, Kings Co.	33-24-22	3,712	suspended
Trico O. & G. Co., No. 2 Atwell, Kings Co.	2-25-22	mtl.	bldg. rig
Buttes Oilfields Co., No. 2 Marysville, Butter Co.	35-16- 1	4,350	Andesite
Milham Expl. Co., No. 3 Tracy, San Joaquin Co.	24- 2- 4	mtl.	bldg. rig
Pure Oil Co., No. 1 Chowchilla, Madera Co.	7-10-14	5,865	sd. sh. drilling
Northern Counties Pet., No. 1 Tehama, Tehama Co.	25-24- 3	164	sd. drilling

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Few Completions and New Operations Reported in North Louisiana and Arkansas District

By J. R. CRUMPTON
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., Aug. 20.—The small total of 10 completions, coupled with only eight new operations, during the past seven-day period reflects the decreased activity throughout this division during the dull summer period. The failure or anticipated failure of several promising wildcats has not served to increase the enthusiasm of operators, but in the face of these reverses, plans are being made to continue an extensive exploration campaign over a wide area.

ARKANSAS

The outstanding disappointment in this district was the abandonment of Earl F. Fox's No. 1 Coleman Brothers, Section 26-16-25, west of the town of Lewisville in Lafayette County. The top of the Blossom was logged at 2,467 feet and although it carried a thick sand body, it contained salt water with no trace of oil or gas and the test was abandoned slightly below the contract depth of 3,005 feet. Another test to the northeast about 7 miles, Benedum & Trees' No. 1 Bodcaw Lumber Co., Section 19-16-23, topped the Nacatoch at 1,866 feet and seems to be checking lower than the Fox well with little chance of getting Blossom production. However, the latter test is scheduled to drill to 4,500 feet.

Two new rigs have recently become active in the Bloomburg area in the southwestern part of Miller County. The Bloomburg Oil Corp. has set 10-inch surface casing at 296 feet in its No. 1 Patterson, Section 5-19-28. This test will be watched with interest as it is only 200 feet east of E. L. Young, trustee's No. 1 Patterson, which recovered 2 feet of oil sand from the Woodbine but was later junked while testing. Southeast of the Bloomburg well, the Oil Well Oil Corp.'s No. 1 Burt Dood, Section 10-19-28, has resumed drilling at 150 feet.

In the vicinity of the Miller County Field, east of Texarkana, two wells have all the earmarks of being good pumpers, while a third failed to encounter the few feet of sand that produces in a limited area. Duluth-Arkansas Oil Co.'s No. 3 Beck, Section 34-15-26, was dry on drill stem test from 2,929 feet and is coring at 2,938 feet. The Texarkana Oil Corp.'s No. 3 E. L. Beck, Section 33-15-26, is waiting on standard rig to pump with 2,500 feet of oil in the hole from a total depth of 2,927 feet. John Wrather's No. 1 E. H. Beck, Section 34-15-26, is arranging to set 5⅛-inch casing at 2,929 feet to test 2 feet of sand at the bottom at 2,932 feet. The King Oil Corp.'s No. 1 C. H. Schroder, Section 24-14-28, a wildcat northwest of the proven field, is making better time since moving in a heavy rig and is coring at 2,400 feet.

A Calhoun County wildcat, R. J. McMurray and others' No. 1 Calion Lumber Co., Section 3-16-14, is drilling at 2,985 feet. The consistency of the Urbana Field in Union County for good pumpers was temporarily halted during the past week. Marine Oil Co.'s No. 1 K. D. Parker, Section 2-18-13, cored salt water sand from 3,566-72 feet, and McCresslen Oil Co.'s No. 1 Union Saw Mill Co., Section 3-18-13, plugged back to cut of salt water from 3,577 feet. The latter company's No. 1-B Hadley in the same section, formerly carried as Wilson & Chapman, was abandoned in salt water at 3,555 feet. The well was plugged back from 3,615 feet.

NORTH LOUISIANA

This district reported a good average of producers from seven completions, three gas wells, two oil wells and two dry holes. One good gasser just over the East Texas line in Cass County, an extension of the Rodessa Field, Caddo Parish, actually comes within the North Louisiana area to make a total of four gas wells during the week in this district.

The United Production Co., operating in East Texas as a subsidiary of the United Gas Public Service Co., extended the Rodessa Trinity gas field one-fourth of a mile west with the completion of its No. 1 T. J. Walton in the John Coleman Survey. The well gauged an initial open flow of 55,300,000 feet of highly saturated gas with 2,200 pounds rock pressure from a total depth of 5,875 feet. This is the third producer to be brought in recently from gas bearing sands below the Oolitic lime from which all previous wells were completed.

In Caddo Parish to the south in the Blanchard Field, W. T. Boyd's No. 1 T. C. Lindsey, Section 34-19-16, is flowing 1,500,000 feet of dry gas from the shallow Nacatoch at 940 feet. The Monroe Field, Morehouse and Ouachita Parish areas furnished one gasser each. In the former, Grecian Bend Gas Co.'s No. 1 Patton, Section 11-20-4e, gauged 17,000,000 feet with 500 pounds rock pressure from 2,155 feet, and in the latter, United Carbon Co.'s No. 3 Cole, Section 25-20-4e, is flowing 1,150,000 feet from 2,179 feet.

The two oil producers were both from the Converse Field in Sabine Parish. Helena Oil & Gas Co.'s No. 1 S. Heard, Section 16-9-13, is flowing 200 bbls. daily from 2,036 feet after the use of acid in the chalk. Windsor Oil Co.'s No. 1 Bank of Pleasant Hill, Section 29-9-13, is flowing 90 bbls. daily without the use of acid from 1,647 feet. In the eastern part of the Zwolle Field, George L. Pace's No. 2 A. C. Phillips, Section 25-8-12, failed to encounter a break in the chalk rock and was abandoned at 2,646 feet. The other dry hole was a rank wildcat in Rapides Parish. Ben Banner's No. 1 Bently Lumber Co., Section 11-6-6, was abandoned as dry at 3,520 feet.

The new locations in the North Louisiana district were all in proven areas with one exception, J. B. Evars' No. 1 Wettermark, Section 35-6n-2e, in Rapides Parish. One new operation was staked in the Bellevue Field, Bossier Parish, one in the Blanchard gas field, Caddo Parish, and the remaining three in the Converse and Zwolle Fields, Sabine Parish.

Two important wildcats, although they have not yet reached the expected pay depths, are reported to be checking low on the formations already contacted. The Gulf Refining Co.'s No. 1-A Crichton, Section 15-18-9, northeast of Sibley in Webster Parish, is drilling in chalk rock at 1,723 feet. This is primarily a Blossom sand test and is being drilled with a gasoline powered rig. In the northern part of Bossier Parish, L. M. Moffitt and others' No. 1 W. H. Martin, Section 31-22-11, is drilling in lime and shale at 2,160 feet. No paleontological reports have been received on either of the above wells, but as stated, reports are that they are checking either regular or somewhat low.

Other North Louisiana wildcats follow: Caldwell Parish—Terrill & Price's No. 1 Louisiana Central Lumber Co., Section 18-11-3e, drilling in sandy shale at 3,233 feet. DeSoto Parish—Hester and others' No. 1 Alston, Section 11-11-16, set 10-inch surface casing at 60 feet and drilling at 260 feet; E. T. Oakes' No. 1 Bryant, Section 30-13-15, made a drill stem test from 5,402 feet, resulting in 32 fourbles of mud with no show of oil or gas; Sunrise Petroleum Co.'s No. 2 Wemple, Section 14-12-11, is arranging to test at 2,665 feet after setting 7-inch casing at 2,606 feet. Natchitoches Parish—Clyde Crichton's No. 1 Friedman estate, Section 52-7-6, drilling in shale at 960 feet. Webster Parish—M. J. Kisick's No. 1 B. M. Cook, Section 2-22-11, has spudded in. This well is located southeast of the town of Springhill in the northern part of the parish.

MISSISSIPPI

One new wildcat operation is reported from this district and a number of others, recently staked, have started drilling. Jack Vale and others are rigging up on No. 1 Moody, Section 3-13n-14e, in Winston County. A Clarke County test, Clarke County Oil & Gas Co.'s No. 1 Kirkland, Section 10-2n-16e, is drilling in gummy shale at 2,055 feet, and in Lamar County, Hix & Germany's No. 1 Newman Lumber Co., Section 21-4n-15w, is drilling at 150 feet. A Madison County wildcat, H. A. Wilson, trustee's No. 1 Copex, Section 24-9-3e, which has been shut down since the first of this year, has resumed activity and cut a core from 2,340-45 feet. The Love Petroleum Co.'s No. 1 Pearl River Valley Lumber Co., Section 15-6n-2e, is making good progress. The test, a contemplated deep hole northeast of the Jackson Field, set 15-inch surface casing at 41 feet, 10-inch subsurface at 860 feet and is drilling in black sandy shale at 3,630 feet.

Wildcat Operations in Louisiana-Arkansas

(Rotary operations unless otherwise designated)

NORTH LOUISIANA

AVOYELLES PARISH

Bell Oil Co.'s No. 1 Woodley, 330 ft. S and W NE cor. NW Sec. 11-2n-5e.
S.D. 1,700 ft.

Haas & Stokes' No. 1 Lindstrum Land Co., 690 ft. S, 980 ft. E, NW cor. Sec. 34-1n-6e.
Set 12-in. 40 ft.

BIENVILLE PARISH

Saline Drlg. Co.'s No. 1 Pardee, Sec. 27-14-6.
Set 10-in. 142 ft.

BOSSIER PARISH

Bossier O. & G. Co.'s No. 1 Sherrill, 300 ft. S and W, NE cor. Sec. 13-9-12.
S.D.; W.O. 2,261 ft.

Dickinson & Pearce's No. 1 Buckelew, 400 ft. N, 55 ft. W, SE cor. NE NE Sec. 16-19-11
Set 10-in. 100 ft.; set 6-in. 320 ft.; T.D. 415 ft.

Dickinson & Pearce's No. 1 Taylor, 160 ft. S and W, NE SW NE Sec. 16-19-11.
Set 6-in. 408 ft.; W.O.S.R. 425 ft.

Howard & Baird's No. 1 Gold, 150 ft S and E, NW cor. Sec. 36-20-13.
S.D. for water 1,126 ft.

L. M. Moffitt et al's No. 1 Martin, 330 ft. N and E, SW cor. NW SW Sec. 31-22-11.
Drlg. 2,160 ft.

McKinney & Stewart's No. 1 Nattin, 470 ft. W, 620 ft. S, NE cor Sec 32-22-14
S.D. 2,978 ft.

Producers O. & G. Co.'s No. 1 Weiner, 660 ft. N and W, SE cor. Sec. 7-17-11.
Reaming to bottom 3,934 ft.

CADDO PARISH

Ark.-La.-Tex. O. & G. Co.'s No. 1 Simon, 330 ft. N and E, SW cor. Sec. 15-20-15.
Tested S.W. 1,560 ft.

W. T. Bell et al's No. 1 Bostick, 1,320 ft. E, 660 ft. N, SW cor. Sec. 13-23-16.
S.D. for water, 2,540 ft.

S. Bender's No. 1 Starr, 150 ft. N, 195 ft. E, SW cor. SW Sec. 26-20-16.
Set 10-in. 100 ft.; drlg. 1,150 ft.

Blunt et al's No. 1 Perry, 200 ft. S and E, NW cor. SE SW Sec. 3-20-16.
Drlg. 250 ft.

Burkett O. & G. Co.'s No. 1 Lindholm, 400 ft. S and E, NW cor. NE SE Sec. 15-17-14.
S.D. 1,046 ft.; repairing rig.

Capitol O. & G. Co.'s No. 1 Noel Est., 300 ft. S and E, NW cor. NE Sec. 13-20-16
S.D. 450 ft.

A. D. King, tr.'s No. 1 Roach, 441 ft. E, 375 ft. N, SW cor. SE Sec. 4-14-16.
S.D. 2,133 ft.

Simplex Oil Co.'s No. 9 Youree-Randolph, 660 ft. S and W, NE cor. SE Sec. 13-20-15.
P.B., set 6-in. 1,778 ft.

Simplex Oil Co.'s No. 1 Glassell, 330 ft. S and E NW cor. Sec. 23-20-15.
Set 10-in. 120 ft.

CALDWELL PARISH

Terrell & Price's No. 1 La. Central Lbr. Co., 300 ft. N, 200 ft. W, SE cor. NW NE Sec. 18-11-3e.
Drlg. 3,233 ft.

DE SOTO PARISH

L. H. Alderson's No. 1 Peek, SE cor. NW NE Sec. 25-11-13.
S.D. for wtr. 2,030 ft.

Bayou Pierre Oil Co.'s No. 1 B. Y. Wemple, C SE NE SW Sec. 14-12-11.
Rigging up.

Jack Clarke's No. 1 Moore, 330 ft. S and W NE cor. NW Sec. 1-13-15.
S.D. 1,675 ft.

Dempsey & Mansiel's No. 1 Thigpen, 375 ft. S, 330 ft. W, NE cor. SW NE Sec. 33-13-13.
S.D. for wtr. 1,605 ft.

Hester et al's No. 1 Alston, 330 ft. S and W of center of Sec. 11-11-16.
Drlg. 260 ft.

George Le Grande's No. 1 Vance, 180 ft. N and W SE cor. SW Sec. 34-12-16.
Rigging up.

Sunrise Pet. Co.'s No. 2 Wemple, 729 ft. N, 956 ft. E SW cor. NW SW Sec. 14-12-11.
Arranging to test 2,665 ft.

Texas Co.'s No. 13-A Wemple, Sec. 1-12-12.
Drlg. 3,477 ft.

J. S. Tuffree's No. 1 McGill, 450 ft. N, 150 ft. W, SE cor. SW SE Sec. 1-10-13.
S.D. 2,125 ft.

MOREHOUSE PARISH

Grecian Bend Gas Co.'s No. 1 Patton, 750 ft. E, 177 ft. S NW cor. NE Sec. 11-20-4e.
Comp. 17,000,000 ft. gas 2,155 ft.

Zeiger & Bacon's No. 1 Cromett, 400 ft N. 300 ft. W, SE cor. Sec. 41-23-4e.
T.A. 3,111 ft.

NATCHITOCHES PARISH

Clyde Crichton's No. 1 Friedman Est., 406 ft. N, 428 ft. E, SW cor. Sec. 52-7-6.
Drlg. 960 ft.

Jack Let's No. 1 Brown Lbr. Co., 400 ft. S, 300 ft. E, NW cor. NE SW Sec. 27-9-13.
Set 10-in. 21 ft.

Missouri Drlg. Co.'s No. 1 Brown Lbr. Co., 400 ft. N, 330 ft. W, SE cor. Sec. 5-10-10.
S.D. 1,033 ft.

Roy A. Raines et al's No. 1 Raines est., 330 ft. N and E, SW cor. Sec. 28-9-10.
W.O. casing 2,260 ft.

J. B. Storey's No. 1 W. W. Page est., NE cor. SE NW Sec. 18-8-9.
S.D. 1,544 ft.

OUACHITA PARISH

Carbons Consolidated's No. 8 Guthrie, 1,550

(Continued on Next Page)

Daily Production

Estimated daily gross production all companies week ending August 17, 1934:

NORTH LOUISIANA

Bellevue	275
Caddo, light	4,545
Caddo, heavy	1,590
Converse	1,965
Cotton Valley	515
DeSoto and Red River	1,435
Elm Grove	495
Haynesville	3,800
Holly	190
Homer	2,690
Pleasant Hill	195
Sarepta-Carterville	640
Urania	3,130
Zwolle	3,360
Total North Louisiana	24,665

SOUTH ARKANSAS

Champagnolle	1,180
El Dorado	2,425
Lisbon	370
Miller County	1,365
Nevada	920
Smackover, light	2,390
Smackover, heavy	19,540
Stephens	610
Urbana	2,600
Total South Arkansas	31,400

La.-Ark. Wildcats

(Continued from Preceding Page)

ft. N 350 ft. W of SE cor. Sec. 22 in Sec. 50-20-4e.
Set 6-in. 2,103 ft.
Carbons Consolidated's No. 4 Cole, 662 ft. S. 1,969 ft. W. NE cor. Sec. 36-20-4e
P.B. to 2,174 ft.
United Carbon Co.'s No. 2 Cole, 1,320 ft. N. 561 ft. E. SW cor. Sec. 25-20-4e.
Comp. 1,150,000 ft. gas 2,179 ft.

RED RIVER PARISH

Louis L. Glass' No. 1 Dickson, 400 ft. S and W. NE cor. NW SE Sec. 32-12-8.
S.D. 1,004 ft.
Kincaid & Kelly's No. 1 Ober, 315 ft. N. 357 ft. W. SE cor. NW SE Sec. 5-14-10.
T.A. 2,915 ft.
A. D. Mytiler's No. 1 La. Delta Pecan Co., 1,700 ft. N, 160 ft. E. SW cor. Sec. 27-12-11.
S.D. 857 ft.
Oynett et al's No. 1 Thomas, 330 ft. S and E. C Sec. 34-13-8.
S.D. for fuel 740 ft.
W. K. Williams' No. 1 DeMoss Est., 900 ft. S. 330 ft. W. NE cor. Sec. 33-13-11.
Fishing for D.S. 2,468 ft.

SABINE PARISH

R. B. Campbell et al's No. 1 Cook Land Co., 150 ft. N, 300 ft. W. SE cor. NW NW Sec. 35-10-12.
W.O. csg. 1,586 ft.
G. H. Collins' No. 1 Bellieu & Carter, 330 ft. S and W, NE cor. NW SW Sec. 21-9-13.
Tested dry 2,070 ft.; S.D.; W.O.
Graham & Dalton's No. 1 Burkett, 330 ft. N and W of C Sec. 16-9-13.
Washing with oil 1,993 ft.
Halliburton & Meadows' No. 1 Jackson, 330 ft. S and E. NW cor. NE NE Sec. 15-9-13.
Drlg. 1,830 ft.
Helena Oil & Gas Co.'s No. 1 Heard, 330 ft. S and W NE cor. NW NE.
Comp. flowing 200 bbls. 2,036 ft.
Laurel Pet. Co.'s No. 7 Frost Ind., Sec. 20-9-13.
Used acid 1,961 ft.
Zan Lloyd's No. 1 Henderson, 330 ft. N and W, C Sec. 29-9-13.
W.O.S.R. 2,031 ft.
Dr. O. B. Hicks' No. 1 Neal, SE SW SE Sec. 15-9-13.
Set 10-in. 40 ft.
Geo. L. Pace's No. 2 DeSoto Corp., 1,030 ft. S. 990 ft. W. NE cor. SE Sec. 27-10-13.
Dry and abd. 3,460 ft.
W. H. Rowe et al's No. 1 Craig, 330 ft. S and E of C Sec. 32-9-13.
S.D. 1,300 ft.
J. A. Stinson's No. 1 Whitney Corp., 330 ft. S and W, NE cor. Sec. 8-9-13.
W.O.S.R. 3,014 ft.
Valley-Osage Oil Co.'s No. 1 Burkett, 330 ft. S and W NE cor. SW NE Sec. 10-9-13.
W.O.S.R. 1,963 ft.
Windsor Oil Co.'s No. 1 Bank of P. H., 330 ft. N and E SW cor. NE NE Sec. 29-9-13.
Comp. flowing 90 bbls. 1,647 ft.

RAPIDES PARISH

Ben Banner's No. 1 Bentley Lbr. Co., 2,640 ft. E. NW cor. Sec. 11-4n-5w.
Dry and abd. 3,530 ft.
Evars & Collingsworth's No. 1 Hickman, 330 ft. S and E, NW cor. Sec. 40-4-1e.
S.D. 2,130 ft.
C. D. Loe, Trustee's No. 1 Baird Est., SE cor. Sec. 40-5n-1w.
Rigging up.

WEBSTER PARISH

Abney Oil Corp.'s No. 3 Slack, 660 ft. N. 575 ft. W, SE cor. NE SE Sec. 36-22-11
S.D.; W.O. 2,714 ft.
Gulf Ref. Co.'s No. 1-A T. Crichton, est. 330 ft. S and W, C Sec. 15-18-9.
Drlg. chalk 1,723 ft.
M. J. Kisaick's No. 1 Cook, 953 ft. N. 695 ft. E. SW cor. NW NE Sec. 2-22-11.
Drlg. 150 ft.

WINN PARISH

Red River Ref. Co.'s No. 2 Tremont Lbr. Co., 480 ft. N, 150 ft. E. SW cor. SE SE Sec. 26-11-1w.
Drlg. 1,321 ft.

ARKANSAS
CALHOUN COUNTY

R. J. McMurray et al's No. 1 Calion Lbr. Co., 330 ft. N and E SW cor SW NE.
Drlg. 2,935 ft.

HEMPSTEAD COUNTY

Ark. Drlg. Co.'s No. 1 Jones, 1,000 ft. S 600 ft. W, NE SE Sec. 11-14-24.
Set 10-in. 160 ft.
E. A. Austin's No. 1 McWilliams, 300 ft. N and W of SE cor. NW SW Sec. 19-13-23.
S.D. 700 ft.
A. H. Bagnelle's No. 1 Trattner & Rhinehart, Sec. 2-13-26
S.D. 1,992 ft
F. W. Martin & Co.'s No. 1 Lafferty, 500 ft. N and W SE cor. NW Sec. 17-14-24.
Set 10-in. 110 ft.

LAFAYETTE COUNTY

Benedum & Trees' No. 1 Bodcaw Lbr. Co., C NE NE Sec. 19-16-23.
Drlg. 2,465 ft.
Douglas Lawn's No. 1 Camp, 330 ft. S and W NE cor. SW SE Sec. 14-15-23.
S.D. 2,644 ft.
Earl F. Fox's No. 1 Coleman Bros., 330 ft. N and W, SE cor. NW NE Sec. 34-16-24.
Dry and abd. 3,005 ft.
C. V. Lenz' No. 1 Houston, Sec. 19-15-25.
Set 10-in. 160 ft.; drlg. 480 ft.

MILLER COUNTY

Bloomburg Oil Corp.'s No. 1 Patterson, 300 ft. N, 75 ft. W, SE cor. SE NE Sec. 5-19-28.
Set 10-in. 296 ft.
Duluth-Ark. Oil Co.'s No. 3 Beck, SW cor. SE SW Sec. 24-15-26.
Coring 2,938 ft.
Pitzwater et al's No. 1 Norson, SW cor. SE SW Sec. 20-15-27.
S.D. 2,177 ft.
Dr. Harber et al's No. 1 Beck, SW cor. NW SW Sec. 24-15-26.
Set 10-in. 130 ft.
King Oil Corp.'s No. 1 C. H. Schroder, 200 ft. N, 330 ft. E, SW cor. SW NE Sec. 24-14-25.
Coring 2,400 ft.
W. F. Lacey's No. 1 Gibson, 330 ft. S and E, NW cor. SW NW Sec. 36-19-27.
S.D. 3,005 ft.
Magnolia Pet. Co.'s No. 4 Olivet, 330 ft. S and W, NE cor. Sec. 4-16-26.
Rigging up.
Oil Well Oil Corp.'s No. 1 Dodd, 300 ft. S. 300 ft. E, NW cor. SW NE Sec. 10-19-23.
Drlg. 150 ft.
Texarkana Oil Corp.'s No. 3 E. H. Beck, 330 ft. S and W NE cor. SE SE Sec. 33-15-26.
W.O.S.R. 2,927 ft.
John Wrather's No. 1 Olivet, 309 ft. S. 150 ft. E. NW cor. NE.
Comp. pumping 30 bbls. 2,937 ft.
John Wrather's No. 1 Beck, SW cor. SW SE Section 34-15-26.
Arranging set csg. 2,929 ft.; T.D. 2,932 ft.

NEVADA COUNTY

O. F. Whittaker's No. 1-B Guttry, C SE SW Sec. 2-15-20.
Set 10-in. 103 ft.

OUACHITA COUNTY

F. A. Book et al's No. 1 Arnold, Sec. 34-15-16.
S.D. 2,032 ft.
J. D. Reynolds' No. 1 Guttry, 462 ft. S, 150 ft. W, NE cor. NE SW Sec. 21-15-19.
W.O.S.R. 1,506 ft.

UNION COUNTY

Alexander-Head Oil Co.'s No. 1 Union Saw Mill Co., 330 ft. S and E, NW cor. SW S.D. for wtr. 3,025 ft.
Mrs. R. K. Jones et al's No. 1 J. Davis, 330 ft. N and W, SE cor. NW NW Sec. 28-16-14.
Arrng. to test 2,764 ft.
McCreslenn Oil Co.'s No. 2 G. Norman, 330 ft. N and W, SE cor. SE NE Sec. 3-18-13.
Rigging up.
McCreslenn Oil Co.'s No. 1 Union Saw Mill Co., 330 ft. N and W, SE cor. NE NW Sec. 3-18-13.
P.B. from 3,577 ft.
Marine Oil Co.'s No. 1 Parker, 330 ft. N and E SW cor. NE NW Sec. 2-18-13.
Coring 3,572 ft.
Marine Oil Co.'s No. 2-B Union Saw Mill Co., 330 ft. N and E, SW cor. SW NW.
W.O.S.R. 3,590 ft.
Tubal Pet. Co.'s No. 1 Gaddy, 340 ft. N and E, SW cor. SE NW Sec. 14-17-14
S.D.; W.O. 3,416 ft.

MISSISSIPPI
AMITE COUNTY

Mineral Resources, Inc.'s No. 1 Anderson. C NE NW Sec. 14-3n-3e.
S.D. 550 ft.

CLARKE COUNTY

Clarke County O. & G. Co.'s No. 1 Kirkland, 1,320 ft. S, 660 ft. E NW cor. Sec. 10-2n-16e.
Drlg. 2,055 ft.

HINDS COUNTY

Alexander & Weaver's No. 1 Mayer & Gordon, 552 ft. W, 217 ft. S NW cor. NE Sec. 36-6n-1e.
Rigging up.
Atkins & Hightower's No. 1 Sanders, 200 ft. S and E NW cor. SW Sec. 30-6n-2e.
Drlg. 150 ft.

JONES COUNTY

Snow-Black Pet. Co.'s No. 2 Watson, 530 ft. W. 300 ft. S, C Sec. 24-7n-13w.
S.D. 3,100 ft.

LAMAR COUNTY

Hix & Germany's No. 1 Newman Lbr. Co., 200 ft. N, 10 ft. E of C Sec. 31-4n-15w.
Drlg. 150 ft.

RANKIN COUNTY

Love Pet. Co.'s No. 1 Pearl River Lbr. Co., Sec. 15-6n-2e.
Drlg. 3,630 ft.

SIMPSON COUNTY

Berry Corp.'s No. 2 R. T. Berry, Sec. 33-1n-4e.
Set 7-in. 2,048 ft.

WALTHALL COUNTY

Mutual O. & G. Co.'s No. 1 Boyd, SW cor SW SE Sec. 24-2n-9e.
Moving in rig.

WARREN COUNTY

Orbet Drlg. Co.'s No. 1 R. L. Parker, 800 ft. E, CWL Sec. 14-14-1e.
S.D. 3,169 ft.

WASHINGTON COUNTY

Perkins & Dees' No. 1 Lee, 1,500 ft. E, 600 ft. N, SW cor. Sec. 33-18n-3w.
Set 10-in. 200 ft and S.D. (corrected).

WINSTON COUNTY

Jack Vale et al's No. 1 Moody, 718 ft. N, 667 ft. E, SW cor. NW SW Sec. 3-13n-14e.
Rigging up.

La.-Ark. Proven Fields

NORTH LOUISIANA
CADDO—BLANCHARD

W. T. Boyd's No. 2 T. C. Lindsey, 660 ft. S and W of C Sec. 34-19-16.
Rigging up.
Louana O. & G. Co.'s No. 2 Lindsey, 450 ft N and E, SW cor. NW SW Sec. 34-19-16
Set 8-in. 40 ft.; coring 922 ft.
Producers & Pyramid's No. 2 Hammock, 400 ft. S and E. NW cor. SW.
Dry and abd. 913 ft.

CADDO—HOSSTON

Bayou State O. & G. Co.'s No. 1 Connell 1,900 ft. N, 1,198 ft. E. SW cor. Sec. 18-21-14.
W.O.S.R. 964 ft.
C. G. Gibbon's No. 1 Burglass, 578 ft. N, 660 ft. W, SE cor. NE NE.
Set 10-in. 54 ft.; drlg. 100 ft.
Shore Line Oil Co.'s No. 43 Crystal, Sec. 13-21-16.
W.O.S.R. 1,048 ft.
Shoreline Oil Corp.'s No. 44 Crystal, 320 ft. S and E of C Sec. 13-21-16.
Rigging up.
Shore Line Oil Corp.'s No. 2 Harrell, 250 ft S and E of C Sec. 2-21-16.
Set 7-in. 1,021 ft.
Shore Line Oil Corp.'s No. 1-B Standard. 250 ft. N and W, SE cor. Sec. 12-21-16.
Reemtd. 1,055 ft.

CADDO—BODESSA

Ark.-La. Pipe Line Co.'s No. 1 Parker, 730 ft. S, 450 ft. E, NW cor. NE NW. Sec. 34-23-16.
Set 10-in. 3,485 ft.
United Gas Pub. Ser. Co.'s No. 1 Christian 734 ft. N, 1,383 ft. W SE cor. Sec. 23-23 18
Fishing for reaming tool 3,090 ft.

SABINE PARISH—ZWOLLE

Alexander & Cane's No. 1 Fogman, SE cor N½ SW NE Sec. 18-7-11.
S.D. 1,700 ft.
Ivan A. Allen's No. 1 La. Long Leaf, 330 ft. N and W, SE cor. NW SE Sec. 13-7-11
S.D. 1,920 ft.
Dyer et al's No. 1 McCollister, 330 ft. S and E, NW cor. SW NE Sec. 34-7-12.
S.D. 1,100 ft.
Foster & Hartman's No. 1 Bowman-Hicks 330 ft. S and E, NW cor. NE Sec. 10-7-11
S.D.; W.O. 2,696 ft.
E. D. Holcomb's No. 1 Porter, 330 ft. S. 330 ft. W, NE cor. SE Sec. 7-7-11.
W.O.S.R. 2,580 ft.
H. C. Maulding's No. 2 DeLatin, 330 ft. S and E, NW cor. NE SE Sec. 2-7-11.
S.D. 2,250 ft.
Monroe Prod. Co.'s No. 1 Bowman-Hicks 330 ft. N and E SW cor. SW SE.
Used acid 2,480 ft.
George L. Pace's No. 2 Phillips, 330 ft. N 80 ft. W SE cor. Sec. 25-8-12.
Dry and abd. 2,646 ft.
Geo. L. Pace's No. 1 Ritter, 430 ft. N, 330 ft. E, SW cor. SW SE Sec. 26-8-12.
Set 10-in. 40 ft.; drlg. 150 ft.
Pelican Nat. Gas Co.'s No. 33 La. Long Leaf 183 ft. S, 283 ft. E. cen. Sec. 29-8-11.
Tested dry 2,636 ft.; S.D.; W.O.
Pelican Nat. Gas Co.'s No. 44 La. Long Leaf, 100 ft. S and E, NW cor. NE SW Sec. 17-7-11.
Rigging up.
Pelican Nat. Gas Co.'s No. 14 Sabine Lbr. Co., 330 ft. N and W, SE cor. NE SW Sec. 11-7-12.
Tested dry; W.O. 2,642 ft.

TEX.-LA.-ARK. Oil Co.'s No. 1 Pickering Lbr Co., Sec. 3-3-12.
Drlg. 2,210 ft.

EAST TEXAS (BORDER COUNTIES)
CASS COUNTY

United Gas Public Service Co.'s No. 1 Weldon, John Coleman Sur.
Comp. 55,000,000 ft. gas 5,875 ft.
R. K. Kamon et al's No. 1 Savage, Mary Patterson Sur.
S.D. 4,016 ft.

HARRISON COUNTY

R. C. Payne et al's No. 1 Lowery, E. D. Spain Sur.
P.B. to 3,524 ft.

PANOLA COUNTY

R. H. Davis' No. 1 Wooten Est., Winnie Mann Sur.
S.D. for wtr. 1,906 ft.
Givens & Holloway's No. 1 Wooten est Winnie Mann Sur.
Drlg. 1,155 ft.
R. W. Price's No. 1 Crawford, J. A. Williams Sur.
Rigging up.
Fred Stovall Drlg. Co.'s No. 1 H. B. Ivey. P. Martin H.R.S.
Rigging up.

SHELBY COUNTY

Bush Oil Int.'s No. 1 Windham, W. M. Blackburn Sur.
S.D. 3,366 ft.
Cliff Stovall's No. 1 Pickering Lbr. Co., C. H. Patterson Sur.
Set 10-in. 30 ft.
Turner & Nell's No. 1 Pickering Lbr. Co., P. W. Harvey Sur.
S.D. 250 ft.

ALABAMA
CLARKE COUNTY

Magnolia Pet. Co.'s No. 1 Scotch Lbr. Co., 350 ft. N, 310 ft. E, C Sec. 17-10n-8e.
Drlg. 5,984 ft.

HOUSTON COUNTY

Rice O. & G. Co.'s No. 1 Oakley est., SE cor. NW SW Sec. 9-3n-10e.
S.D. 1,810 ft.

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Dry Creek Oil Co.'s Discovery in the Big Horn Basin Gives Promise of New Light Oil Pool

By TOLBERT R. INGRAM
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Aug. 20.—Wyoming reported an important discovery in the Dry Creek Oil Co.'s No. 1, south of the Oregon Basin Field, which encountered 8,000,000 feet of gas in the top of the Frontier at 900 feet and proved the closure of a large fault block.

Shell Petroleum Corp. has staked a location for a semi-wildcat on the southeastern side of the Hobbs structure in New Mexico. There were no completions at Hobbs. Two wells in the Eunice Pool are near completion. The Humble Oil & Refining Co.'s No. 1 Cooper, half a mile northeast of the nearest oil well in the Cooper area, had a 10,000,000-foot gas blowout at 3,053 feet. One well was abandoned in Eddy County and two new operations were reported in Roosevelt and Chaves Counties.

Crude oil marketing conditions in northern Montana are resulting in conferences of operators and state and Federal officials. Five completions and two new locations were reported in the Cut Bank Field. The best completion, an outside well in the northwestern part of the field, was the Texas Co.'s No. 1 Morrison, which swabbed 151 bbls. in 12 hours. Two completions and one new location were reported in the Kevin-Sunburst Field. The Barmac Oil Co.'s No. 1 Bruning, which limits the Cut Bank trend on the southeast, is pulling casing to abandon.

Stanolind Oil & Gas Co.'s No. 33-SD Parkinson, on the Iles Dome, in Colorado, cored more than 200 feet of Sundance sand and on a test made a maximum of 110 bbls. an hour at 77 feet in the sand. One well was abandoned at Tow Creek.

Utah has an important wildcat drilling in Emery County which had a good show of rich wet gas above the first oil objective.

NEW MEXICO

Lea County

Pipe line runs from Lea County pools, in barrels, in July were as follows: Hobbs, 1,101,772; Jal, 90,963; North Lea, 1,160; Lea, 51,341; Cooper-Lynn, 14,853; Eunice, 81,508.

July runs from Hobbs brought the total since proration went into effect up to 47,363,773 bbls.

Hobbs Area

Shell Petroleum Corp.'s new location is on the southeastern side of the Hobbs Pool for its No. 1 Sanger, SW cor. Section 27-18-38, and it will be an interesting semiwildcat. It is an offset on the north to the Stanolind Oil & Gas Co.'s No. 8 Turner, a drilling well, and half a mile east of the Continental Oil Co.'s No. 1 Grimes, a recent completion for 6,788 bbls. of oil and 19,866,000 feet of gas after treatment with acid. No. 8 Turner, in turn, is one-third of a mile away from the nearest producer.

Shell's No. 1-D State, SE cor. NW Section 24-18-37, on the northwestern side of the pool, is spudding at 98 feet. Stanolind Oil & Gas Co.'s No. 8 Turner, C NW NW Section 34-18-38, is drilling at 3,980 feet in lime. Gypsy Oil Co.'s No. 9 West Grimes, NW cor. SW Section 32-18-38, is drilling at 167 feet, and its No. 3 Graham, SW cor. NE Section 24-18-37, is standing at 4,002 feet with the 7-inch cemented. Last named had a show of oil at 3,234 feet. Gypsy's No. 3 East Grimes, NW cor. NE Section 33-18-38, is a near completion. Total depth is 4,216 feet in lime, and the 3-inch tubing was run with packer and it is waiting for test.

Eunice Area

The Repollo Oil Co.'s No. 1 State, NE NW NE Section 19-21-36, is bottomed at 3,850 feet and is waiting after recementing whipstock at 3,824 feet to drill by tools. The Tide Water Oil Co.'s No. 3 Coleman, C NE NE Section 17-21-36, is building derrick. The Shell-Devonian's No. 1 State, C SW NE Section 20-21-36, is moving in materials. This is corrected location from the C NW NE of the same section.

Cooper Area

Humble Oil & Refining Co.'s No. 1 Cooper, C NW NE Section 23-24-36, half a mile northeast of the General Crude Oil Co.'s No. 1 Cushing, the nearest of the two oil wells in this area, had a gas blowout at 3,053 feet .The gas was estimated at 10,000,000 feet a day. The well was killed and it is drilling ahead at 3,142 feet, in lime. Same company's No. 1 Coats, C NW NE Section 10-24-36, is building derrick.

Phillips Petroleum Co. has a near completion in its No. 1 Woolworth, NW cor. SW Section 23-24-36, which is coring in lime at 3,504 feet. It made a drill stem test at 3,420-34 feet and showed for an estimated 500,000 feet of gas. Same company's No. 2 Woolworth, NW NE SW Section 23-24-36, is drilling at 3,410 feet in lime, and its No. 3 Woolworth, SW cor. NW Section 23-24-36, is drilling at 1,900 feet in sand. Phillips No. 4 Woolworth, C SW SW Section 23-24-36, is drilling at 3,091 feet in lime.

The Texas Co.'s No. 1 Ogg, C SW NE Section 35-24-36, is shut down for water at 1,073 feet. Stanolind Oil & Gas Co.'s No. 1 Meyers, SE cor. NE Section 22-24-36, is shut down at 3,130 feet waiting for blowout preventer. General Crude Oil Co.'s No. 2 Meyers, C SE SE Section 22-24-36, is drilling at 3,362 feet in lime.

Jal Area

The Continental Oil Co.'s No. 13-A-1 Sholes, C SW SE Section 13-25-36, succeeded in getting the 7-inch down to 3,276 feet, after sidetracking tools, and cemented it at that depth with 400 sacks. Total depth is 3,287 feet. The Repollo Oil Co.'s No. 2-A Stephens, NW cor. NE Section 13-25-36, is fishing for drill stem at 2,982 feet, total depth.

Eddy County

Flynn, Welch & Yates' No. 1 Vickers, C SE SW Section 34-20-28, Artesia district, encountered a hole full of sulphur water at 1,000 feet and was plugged and abandoned.

Chaves County

Several reports point to the probability of a wildcat play this fall in Chaves and Roosevelt Counties on the northwest trend from the Texas line. C. J. Franks and others have made a location for a test southeast of Roswell in their No. 1 Roswell Insurance & Surety Co., C NE NE Section 30-11s-25. It is 800 feet from the Sterrett well drilled for water which encountered a show of oil in a 35-foot sand at 880 feet. The Franks test will go to that horizon.

Roosevelt County

The Claudell Development Co.'s No. 1 Wilmes, C SW SE Section 21-2s-30, Pomeroy district, is rigged and ready to spud. This location is 24 miles west of Portales on the Pomeroy anticline and 9 miles south of a test drilled several years ago and abandoned as a dry hole at 4,150 feet.

MONTANA

Glacier County

Five completions and two new locations were reported in the Cut Bank Field. The best completion was in the Texas Co.'s No. 1 Morrison M-358, Lot 5 (NW NE) Section 22-35-6w, which came in as a flowing well and swabbed 151 bbls. in 12 hours after it stopped flowing. This is an outside well on the northwestern side of the development, but in a district where production was expected. Total depth is 2,902 feet.

The Texas Co.'s No. 4 Purdy, SW SW Section 35-35-6w, found the pay at 2,903-29 feet, was drilled to 2,950 feet and pumped 50 bbls. initial.

The Texas Co.'s No. 2 Kearns, W NW NW Section 23-35-6w, swabbed 83 bbls. the first 12 hours at a total depth of 2,871 feet.

The Texas Co.'s No. 4 Hinkle, C SE NE Section 2-34-6w, cemented the 7-inch at 2,760 feet with 60 sacks, cut the pay at 2,790-2,818 feet and was completed at 2,828 feet. It pumped 35 bbls. initial.

Annand & Hutchins' No. 1 Federal Land Bank, NW cor. SW Section 11-34-6w, an outside well on the western side, found the pay at 2,885-2,901 feet, and was completed at 2,907 feet with 1,500 feet of oil in the hole. It will make 30 to 40 bbls. initial.

The two new locations staked are the Montana Power Gas Co.'s No. 1 De Zort Unit, 700 feet north of the south line and 2,640 feet west of the east line, in the gas area, and the Santa Rita Oil & Gas Co.'s No. 4 Tribal, C N half SW Section 15-35-6w, in the Indian reservation near the northwestern edge of the development.

Consolidated Gas Co.'s No. 2 Ewing

Deliveries to the Calgary Refineries From Turner Valley Were Less in July

By VICTOR LAURISTON
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Aug. 18.—Deliveries to the Calgary refineries from the Turner Valley Field in July totaled 89,352 bbls., comparing with 91,327 bbls. in June. The record for 1934 was in March, 94,723 bbls. Deliveries to Imperial Oil Refineries, Ltd., in July included 9,013 bbls. of clear naphtha, 64,830 bbls. of discolored naphtha, and 6,371 bbls. of light crude oil; comparing with 7,532 bbls. of clear naphtha, 70,986 bbls. of discolored naphtha, and 5,592 bbls. of light crude in June. Deliveries of 9,133 bbls. to Bell Refining Co. in July compared with 7,216 bbls. in June.

In Section 28-18-2w5, South Turner Valley, Century Royalties' No. 1, LSD 14, is drilling in the lime after cementing 6-inch at 5,860 feet. Pacalta Oils' No. 1, LSD 7, is finishing a difficult fishing job in the lime at 5,120 feet. It has a fair wet gas flow. Spooner Oils' No. 5 Anaconda, LSD 1, same section, in shale at 5,235 feet and expected to get the lime around 5,290 feet, has been getting intermittent oil and gas shows.

Offsetting Richfield's No. 1 to the southeast, Renfrew Royalties' No. 1 Morris & Goodfellow, LSD 3, is spudding with cable tools. Frank Becker is supervising operations.

In Section 21-18-2w5, Highwood-Sarcee Oils' No. 1, LSD 16, is reported making a steady production of somewhat better than 500 bbls. a day from the Madison lime. Northwest Royalties' No. 1 Prairie, LSD 5, is drilling out cement at 1,400 feet after striking a fair gas flow.

Nolan-Hungerford Royalties' No. 1 Rand, LSD 5, Section 34-18-2w5, got the Benton shale at the unexpectedly shallow depth of 294 feet and is now below 410 feet.

Tests in the Foothills

On the Pekisko structure south of Turner Valley, Pekisko Co.'s No. 1, LSD 6, Section 6-17-2w5, is in the Madison lime below 1,900 feet. It got the lime at 1,071 feet, an exceedingly shallow depth, encountered a recurrence of the Fernie shales between 1,235 and 1,300 feet, and then re-entered the lime, encountering dry gas at 1,480 feet and traces of light crude around 1,738 feet.

Mar Jon Oil Co.'s No. 3 Prairie, LSD 3, Section 4-10-2w5, is reported rigging.

In the old Oil City Field, Waterton Lakes Park, Oil City Royalties' No. 1 Patrick, Section 30-1-30w4, has a gas show in a hard formation below 1,800 feet.

Skiff Test Spudding

In the Skiff Field, southern Alberta, Devenish Petroleums' No. 5, LSD 4, Section 27-5-14w4, has spudded. The company plans if sufficient production can be developed by systematic drilling to erect a refinery equipped to process the asphaltic crude.

Start Cardston Test

In the Cardston district, southern Alberta, Franco Oils, Ltd., last week spudded Cardston Gas & Development Co.'s No. 1, LSD 6, Section 5-3-25w4, a mile west of Cardston. Drilling will test a potential structure for natural gas, to be distributed to the town of Cardston for which the company has secured a franchise. Plans call for expenditure of approximately $40,000 on a distribution system if gas production is secured.

Border Fields

On the Twin River structure south of Lethbridge, Nordon-Roney's No. 2 Twin River, LSD 11, Section 2-2-20w4, is shut down pending instructions. It treated an oil sand in the top of the Madison lime at 3,930 feet with acid, after a shot, but results have not been made public.

SE SE Section 34-35-6w, for which location was released in June, is spudding. W. M. Fulton and others' No. 2 Haggerty, C NW NW Section 15-34-6w, which has been standing at 693 feet since last June, has been taken over by George Nadeau to complete. Montana Power Gas Co.'s No. 1 Hawkins, C SW Section 17-33-5w, is fishing at 2,680 feet. The same company's No. 1 Pioneer Lumber Co. Unit, SE cor. Section 21-35-5w, topped the Colorado at 480 feet and cemented the 12½-inch on bottom at 543 feet, and its No. 1 Van Ormer, C SE SW Section 8-33-5w, topped the Colorado at 525 feet and cemented the 10-inch on bottom at 705 feet. Par Oil Co.'s No. 4 Haines, E SE SE Section 2-34-6w, is rigging up. R. C. Tarrant's No. 2 Reickhoff, SW NW SE Section 3-34-6w, is standing with rig completed.

Toole County

Two completions and one new location were reported in the Kevin-Sunburst Field. The Big West Oil Co.'s No. 2 Sorrell, C NE SE Section 7-34-2w, cut the Sunburst sand at 1,204-38 feet and the Ellis at 1,478-97 feet. It was plugged back and completed in the Sunburst for 250,000 feet of gas. The Potlach Oil & Gas Co.'s No. 2 fee, NW SW SW Section 21-34-1w, cut the pays at 1,100-28 and 1,210-30 feet and was completed at 1,246 feet for 100 bbls. of oil and 700,000 feet of gas.

The new location is the Potlach Oil & Gas Co.'s No. 3 fee, NW NE SE Section 21-34-1w. A location has been made for a test northeast of the Kevin-Sunburst Field in the Bow and Arrow district in T. P. Kyle's No. 1 Clark, SW Section 19-37-1e. It is a wildcat.

Teton County

Ned Cheadle and others' No. 1 Balsinger, NE SE NW Section 20-27-5w, West Pondera, had 1,000 feet of water in the lower Cut Bank sand at 2,323-32 feet. The Sunburst at 2,270-75 feet was dry.

Pondera County

Barmac Oil Co.'s No. 1 Bruning, C SW SW Section 1-31-5w, Vallier district, which was looked upon as a possible extension of the Cut Bank Pool to the southeast, is pulling casing to abandon at 2,787 feet. The Cut Bank sand was missing. It topped the Ellis at 2,660 feet.

Petroleum County

Guy Smith and others' No. 1-A, SE cor. Section 3-13-26, Flatwillow, is through the third Cat Creek sand at 1,710 feet, and is carrying the 6⅝-inch to continue to the Ellis. The Cat Creek sand had water.

COLORADO

Moffat County

Stanolind Oil & Gas Co.'s No. 33-SD Parkinson, SE SW SE Section 22-4n-92, near the top of the Iles Dome, an old well drilling deeper to core the Sundance sand, is bottomed at 3,502 feet and still in sand. The well was completed in 1928 and made 2,617 bbls. the second 24 hours. Total depth with cable tools was 3,290 feet, just in the Sundance. The rotary found the bottom of the hole at 3,296 feet, which put the sand at 3,294-96 feet. Coring showed the following results: At 3,296-3,326, dry sand; 3,326-3,429, oil sand; 3,429-69, dry sand; 3,469-84, oil sand; 3,484-3,502, dry sand.

It is planned to run the 6¼-inch to approximately 3,294 feet to shut off 150 feet of open hole in the Morrison. At 3,371 feet the hole was unloaded and the well was tested by various methods for two days. The maximum flow was 110 bbls. an hour through casing and the minimum 59 bbls. through the tubing. There was no water trouble. The purpose of the company other than to find out the thickness of the Sundance sand and determine the productivity of the various horizons on the top of the structure has not been disclosed.

The Stanolind company is going back into its old No. 24-M Parkinson, NE SE NW Section 22-4n-92, which was completed in the Morrison in 1929 and plug back to the Dakota and make it into a water well for camp and lease purposes.

Mountain Fuel Supply Co.'s No. 4-B Wilson, C NE NW Section 23-12-100, Hiawatha district, is drilling at 3,294 feet, and the Texas Co.'s No. 1 Van Schaick, SW cor. Section 19-12-100, is drilling at 1,903 feet and carrying the 8⅝-inch.

Routt County

The Texas Co.'s No. 5 Carstarphen, NW NE NW Section 5-6n-86, Tow Creek, is pulling pipe to abandon at 3,945 feet, and its No. 8 Quaintance-Hocking, NE SW NE Section 18-6n-86, is moving in materials.

Jackson County

The Colorado Oil Refining Co.'s No. 1 North Park Coal Co., NW NW Section 18-9n-78, North McCallum, is drilling at around 1,800 feet.

Boulder County

Leslie R. Steele's No. 1 Cole, NW cor. NE Section 33-1n-70, Parallel Dome, bridged the hole at 350 feet to cement the 8¼-inch and is drilling ahead at 865 feet after cleaning out.

Adams County

Riddle Petroleum Co.'s No. 1 Baxter, C SW Section 2-3s-66, Derby district, is building derrick.

Park County

South Park Oil Co.'s No. 1 State, SE cor. SW Section 16-11-75, Hartsell district, spudded August 12 and shut down to completed rigging.

WYOMING

Park County

An important discovery which gives promise of opening a new light oil pool in Wyoming was made this week in the Big Horn Basin in the Dry Creek Oil Co.'s No. 1 on Lot 2 (NE SE) Section 9-50-100, on the Oregon Basin structure. A flow of 8,000,000 feet of gas a day was encountered in the top of the first Frontier sand at 900 feet, the drill having penetrated the sand only 1 foot. The significance of the strike lies in the fact that it proves the closure of a large fault block with an immense drainage area on the south end of the structure underneath which lie a number of sands within reach of the drill. Some of these sands normally carry light paraffin base crude and the others are black oil sands. The well is located 1½ miles south of the nearest producer and in a district which operators in the pool heretofore have passed up and in which the major companies have practically no leases.

The Frontier is exposed at the surface on the north and south domes and the first important discovery was made in the Cloverly formation, which yielded gas, about 1912. Six gas wells were completed in that horizon up to 1920 and in 1926 the Ohio Oil Co. drilled a deep test which found black oil in the Embar-Tensleep formation. No light oil has heretofore been produced commercially on either the north or south domes.

On the Frannie Dome, Val M. Kirk and others' No. 2 Kirk, SE SW SW Section 24-58-98, is spudding. Stanolind Oil & Gas Co.'s No. 6 Rosenberg, NW cor. Section 25-58-98, Frannie Dome, is drilling at 1,143 feet.

Big Horn County

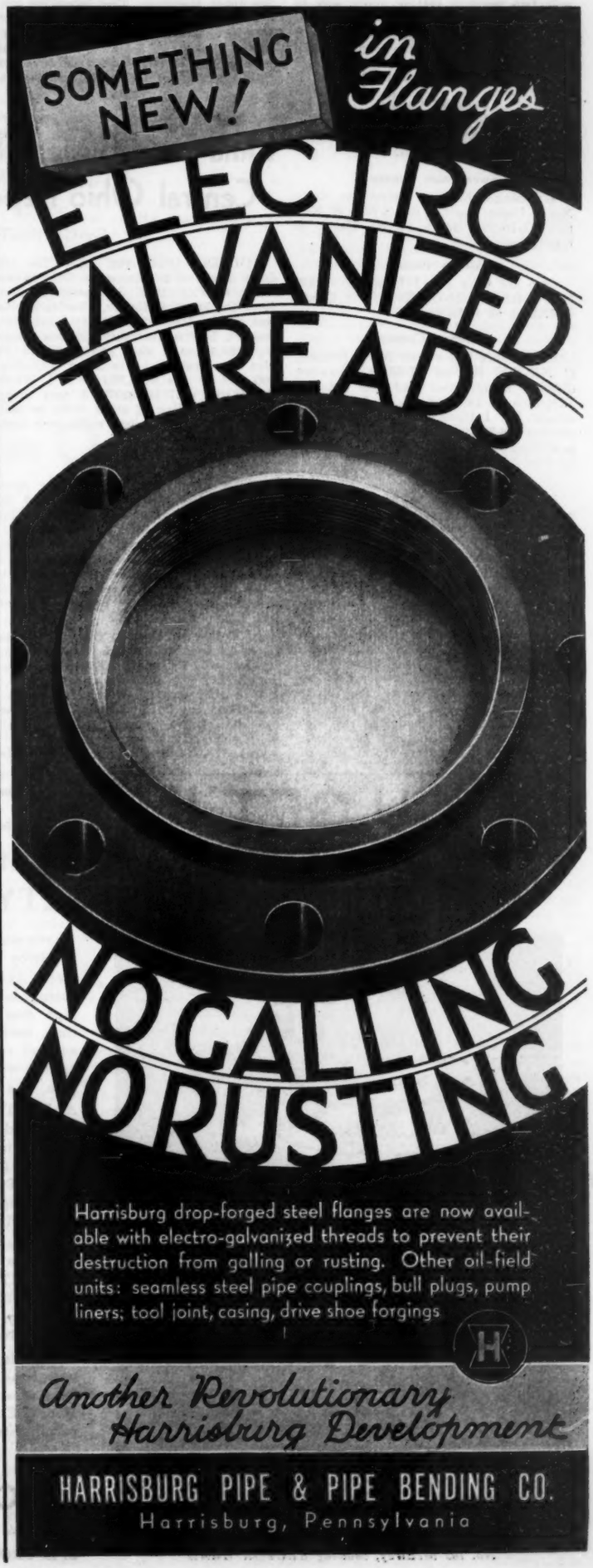
Peter Evanoff and others' No. 1 Griffin, Lot 60, Section 4-55n-97 (cor.), is building 122-foot steel derrick. It is on deeded land inside the unitized area, but the operator is not a party to the unit agreement and has application for authority to drill pending before Administrator Ickes.

Hot Springs County

Argo Oil Co.'s No. 10 Ellen, NW SE NW Section 14-44-98, Hamilton Dome, recently completed for 200 to 300 bbls. at 2,795 feet, increased on a swabbing test to 700 bbls. daily. It is estimated at 500 bbls. a day on the pump.

Natrona County

The first active drilling operation reported in the Salt Creek Field in the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past two years is getting under way in the Sinclair-Wyoming Oil Co.'s No. 11-A, E SE SE Section 30-40-78 an old well drilling deeper from the second Wall Creek at 2,490 feet. It is making new hole at 2,586 feet.

Fremont County

Mid-American Oil Co.'s No. 1 Government, NE SW Section 4-28-92, Sheep Creek, is drilling at 1,157 feet.

Sweetwater County

Wyoming-California Petroleum Co.'s No. 2 Union Pacific, SE NW SW Section 11-16-104, South Baxter Basin, is rigging up.

Albany County

Ohio Oil Co.'s No. 1 Chappell, C SE NW Section 28-21-76, East Rock Creek, is drilling at 4,485 feet.

Converse County

E. B. Jones and others' No. 1 Pitman, C NE NE Section 27-32-69, Shawnee district, is resuming and has set the 12½-inch at 735 feet. R. J. Dilger and others' No. 1 Government, SE NE SW Section 33-31-72, Poison Lake district, is drilling at 400 feet.

UTAH

A structural test in southern Utah which is beginning to attract attention is the Ramsey Petroleum Corp.'s No. 1 Weightman, SW NE SW Section 13-26-7e, Last Chance Dome, Emery County. It is being drilled by Ramsey under a contract with the American Oil Corp., which controls 44,000 acres on the structure. This land was assembled by A. E. Gibson, E. O. Anderson and W. T. Weightman. Part of the structure originally was held by the Shell interests and they were at that time disqualified by the Secretary of the Interior. The test is drilling at 2,590 feet and carrying the 8¼-inch casing. It encountered rich wet gas at 2,530-34 feet, the flow being estimated at 50,000 feet from broken lime in the upper Moenkopi. This formation consists mostly of red sandy limestone which stands up without casing. There is no water to contend with at present. The hole passed through 300 feet of cavey Chinle (Triassic) formation, and is now through 340 feet of Moenkopi of lower Triassic. The hole passed out of the cavey formation which caused considerable delay at 2,120 feet and since then it has been making rapid progress toward the first of the four oil objectives.

Lima Field Busier Than in Many Months: Central Ohio Reports 22 Completions

By GEORGE A. WHITNEY

TOLEDO, Ohio, Aug. 18.—The old Lima Field of northwestern Ohio shows more activity than in many months. Near the town of Elmore, Charles Shell's test on the Martin W. Witty farm, Section 14, Harris Township, Ottawa County, was given a shot and produced 10 bbls. the first 48 hours along with 16,000 feet of gas at 1,264-97 feet. While the Witty well is small, it may bring about the drilling of other wells in that part of the field, as few wells have been drilled in the county.

CENTRAL OHIO

The Central Ohio Field is the most active in the Central West area, with 22 completions, 5 oil wells, with an initial of 164 bbls., 5 dry holes and 12 gas wells.

In Ashland County, First National Bank of Newark's No. 1, on the McClure property, in the SW Section 10, Lake Township, is a gas well, at 575 feet. No. 2 on the same property showed but 1 bbl. at 565 feet.

In Coshocton County, Ohio Fuel Gas Co.'s No. 3-5,809, R. H. Griffin farm, in Lot 6, Newcastle Township, produced 92 bbls. initial at a depth of 3,188 feet. Preston Oil Co. is drilling No. 3-1,546 on the D. S. Snyder farm, same township. Same company's No. 5-1,551 E. R. Van Winkle farm, showed 1 bbl. initial at 3,062 feet. Same company made a location for No. 2 Carey D. Harris farm, Section 17, Perry Township.

In Muskingum County, Pure Oil Co.'s No. 4 Albert Holeman farm, Section 6, Jackson Township, was a dry hole at 3,095 feet. Joe Pierce's No. 3, on the Brown-Swisher farm, Section 3, Blue Rock Township, came in dry at 1,218 feet. Atha Oil & Gas Co. is drilling No. 9 B. S. Payton farm, Section 10, same township.

In Tuscarawas County, James Upham's No. 1 Alfred Ehlers farm, Lot 4, Fairfield Township, produced 40 bbls. at 4,870 feet. Frey and others' No. 6 J. H. Weaver farm, Lot 4, same township, is a gas producer at a total depth of 5,094 feet.

INDIANA

More development work is looked for in the Indiana Field for the coming months. In Pike County, P. C. Andrews' No. 12, on the A. Atkinson farm, Section 23, Logan Township, produced an initial of 65 bbls. at a total depth of 1,356 feet. Wiser Oil Co. abandoned No. 4 on the William Phillips farm, in Section 23, Logan Township. Claude Noble is expected to start another well on the Edward Adams farm, Section 20, Washington Township. H. H. Risher abandoned No. 1 Frank Andrews farm, Section 30, same township.

In Gibson County, Big Four Oil & Gas Co.'s No. 8, on the Catherine Sloane farm, NW SW Section 18, produced an initial of 150 bbls. Gib Van Oil Co. is drilling No. 2 G. W. Shoults farm, same section. Briggs & Douglass are drilling No. 5 on the Mary E. Watkins farm, Section 7, Patoka Township. P. E. Hill drilled a dry hole on the Renna Pumphrey farm, NE NW Section 1, Union Township. M. V. Yeager and others' test on the Link A. Morris farm, NW NW Section 8, Fairbanks Township, was dry at 2,486 feet.

ILLINOIS

Only one completion was reported from the Illinois Field, Collins and others' test on the Stella Tansey farm, NE Section 18, Renault Township, Monroe County, and it was a dry hole at from 870 to 945 feet. In Bond County, Alspaugh, Mason & Ashby are drilling on the Martha E. File farm, Section 32, Old Ripley Township, and Jess Ashby is drilling No. 1 William File farm, Section 5, same township.

KENTUCKY

Several wells were completed in the Kentucky Field, mostly in Ohio County. Penn-Indiana Oil Co.'s No. 11, Laura Mercer 84 acres, made 10 bbls. In the Matthews Pool, W. E. Hupp & Co.'s No. 1 C. H. Downs farm, was dry at 375 feet. Same company's No. 8 J. W. Odell property, in the Matthews Pool, produced 50 bbls., while No. 9 same farm, produced 150 bbls. Penn-Indiana Oil Co.'s No. 11 Laura Mercer farm of 85 acres in the Swope Pool, produced 10 bbls.

In Athens County, Ohio Fuel Gas Co.'s No. 1-5,817, on the George W. Fulton farm, fractional Section 25-31, Lodi Township, is a gas well at 1,602 feet. In Berne Township, E. N. Williams' test on the John E. Hill farm, Lot 24, was dry at 1,035 feet. In Troy Township, C. & M. Oil & Gas Co.'s No. 4, on the Charles Cole farm, Section 35, was dry.

IF YOU GET IN TROUBLE

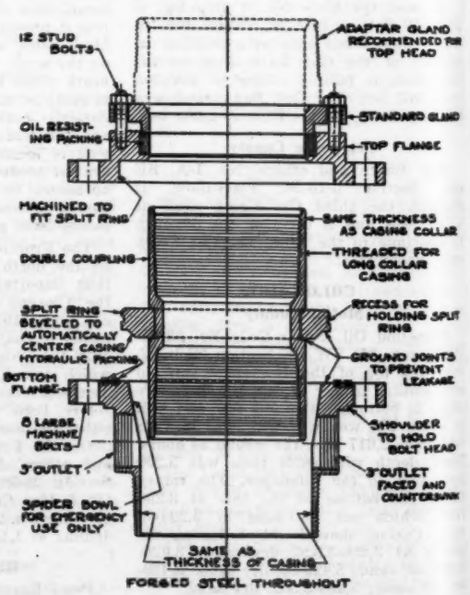
you can *do something* about it WITH THE RECTOR SAFETY HEAD!

No. 103 McElroy, showing RECTOR HEAD

That's why it was used on No. 103 McElroy in West Texas three weeks ago to run 10,301' of 7⅝" casing, longest string of this size pipe ever run. 18 hours running time, without shutdown, hung up another record. Total tension on casing, with 5,700' of mud in the hole, was 275,000 pounds.

A RECTOR 16" to 10¾" head supported 4,015' of 10¾" casing, plus tubing string, Christmas tree, and the pull of the anchor rods. A RECTOR 10¾" to 7⅝" head, with Adapter gland, supported the 10,301' of 7⅝", 34-pound casing.

As in Texas, the deepest well in Louisiana (at Roanoke) is using the RECTOR head. Both operators in the Big Lake deep pay (8500' to 8900') are using these heads, as well as every Ordovician sand wildcat drilled in West Texas.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MACHINED TO FIT SPLIT RING
SAME THICKNESS AS CASING COLLAR
DOUBLE COUPLING
THREADED FOR LONG COLLAR CASING
SPLIT RING BEVELED TO AUTOMATICALLY CENTER CASING HYDRAULIC PACKING
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GROUND JOINTS TO PREVENT LEAKAGE
BOTTOM FLANGE
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SHOULDER TO HOLD BOLT HEAD
3" OUTLET
3" OUTLET FACED AND COUNTERSUNK
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It pays for itself in time saved in handling casing . . . It holds casing in as well as out of the hole . . . It gets your shut-off without putting men in the cellar . . . It permits repacking under pressure without endangering your men. The utility of the Double Collar has greatly simplified the job of handling casing. The Adapter gland permits stabbing over and screwing on in event of wild well.

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Large Gas Completion in Boone County, W. Va.
Ritchie County Drilling on Town Lot Scale

By STAFF CORRESPONDENT

PITTSBURGH, Pa., Aug. 20. — In Washington district, Boone County, West Virginia, Godfrey L. Cabot, Inc., completed a fairly large gas well on the White and Hopkins lease. It reached the Maxon sand at 1,442 feet and is showing for over 6,500,000 feet a day. It was a test on this lease and the same operator has another test in this district drilling on the Spruce Boone Land Co. tract which has reached 880 feet.

There were 14 wells completed in the lower eastern fields during the week and in addition four dry holes. Eight of the completions were gassers and six were producers with an initial production of 99 bbls. a day. There was one fair producer in Southeast Ohio.

SOUTHEAST OHIO

In Monroe County, H. G. Clymer, trustee, and others completed a second test on the W. T. Shafer farm in the SE Section 11, Bethel Township, in the Big Lime at a depth of 1,352 feet. It produced 75 bbls. the first day, natural. In Franklin Township, SW Section 22, Gordon G. Greene and others drilled a test on the E. O. Curtis farm through the Berea grit to 1,810 feet. It was a dry hole.

In Coshocton County, Preston Oil Co. completed No. 5 on the E. Ray and Otta M. VanWinkle farm in Section 17, Perry Township. It was drilled in the Clinton sand at a depth of 3,072 feet and produced 3 bbls. the first day natural and after shot is showing for a 15-bbl. pumper.

In Washington County, F. M. Russell completed a test on the John Zumbro heirs farm in Section 26, Wesley Township, 2 miles south of Dale. It is showing for a 3-bbl. pumper in the First Cow Run sand at a depth of 450 feet. In the same section and township, 5 miles east of Chesterhill, C. P. and J. V. Bowman completed No. 47 on the J. V. Bowman farm in the Peeker sand at 340 feet. It will make a half barrel pumper.

WEST VIRGINIA

There were two small producers completed in West Virginia during the week. In Calhoun County, Bickerstaff and others completed No. 4 on the William Cooper farm in Sheridan district in the Salt sand at a depth of 2,009 feet. It is making 3 bbls. a day.

In Harrison County, on Jacobs Run in Ten Mile district, Raad and Moses completed a second test on the A. P. W. Flanagan farm in the Gordon Stray sand at a depth of 3,250 feet. It is showing for a 2-bbl. pumper.

In Kanawha County, Grosscup and others are still testing the deep well on the W. L. Burdette farm on Coopers Creek, about a half mile from the Elk River in Elk district. The depth is 4,826 feet in the Corniferous lime and the hole has filled 4,000 feet with fluid. Tankage has been set but the well is not completed and no estimate of its size can be made.

In Clay County reconditioning work is still in progress. South Penn Oil Co. cleaned out and shot No. 28 on the O. D. Stockley lease in Henry district and increased production from 4 to 8 bbls. a day.

In the lower end of the old Pike Pool in Clay district, Ritchie County, where a small pool has been located, drilling has reached town lot proportions. In this pool, one well recently completed as a 50-bbl. producer, natural, was shot and it increased production to 240 bbls. a day. Here Murphy and others have started drilling on the Frank Ball lot. J. F. Deem has started drilling on the Church of Christ lot. George Allen is moving in the rig on the Frank Sheets lot. Broadwater and Wilson have made a location on the J. Kelley lease. W. H. Bickle has reached 1,100 feet on the Fred Pifer lease. Lucas and Mahaney are drilling at 670 feet on the Earl Cunningham lot. Smith and Hendershot have passed the 1,000-foot level on the Charles Wilcox, Sr., property.

Gas Wells

There were seven additional gas wells completed in West Virginia. In Sherman district, Boone County, Godfrey L. Cabot, Inc., completed No. 53 on the Federal Coal Co. lease in the Weir sand at 3,316 feet. It is good for 220,000 feet a day.

In Calhoun County, H. B. Scott completed a small gas well on the P. Fling heirs farm in Sherman district. It was drilled in the Injun sand at 2,108 feet and has not been shot.

In Gilmer County No. 4 on the Cora B. Gainer farm in DeKalb district, which failed of production in the Salt sand, was drilled to the Injun sand by its owners, Clem Morris and others, and it has about

(Continued on Next Page)

Two Producers in Oceana County, Michigan; Ogemaw County Well Estimated 150 Bbls.

By PAUL A. ELLIOTT
Staff Correspondent, Michigan Fields

MUSKEGON, Mich., Aug. 20.—Two good producers, one estimated 400 to 500 bbls. a day and the other 100 to 150 bbls., were completed in the upper Traverse in Oceana County, western Michigan. A 150-bbl. Dundee producer was developed in the Ogemaw County Field, eastern Michigan, about 50 miles north of Mount Pleasant.

John B. Northcott's No. 1 Jane Pinder, NW NW Section 31-15n-16w, Elbridge Township, Oceana County, came in wild Friday and flowed over the top of the derrick for three hours before it could be connected with field tanks. It had previously been supposed dry after three unsuccessful acid tests in the upper Traverse but was discovered to be not deep enough for the big pay when H. C. Nelson's No. 2 Myrtle Spitler, SW NW Section 21-15n-16w, also Elbridge Township, a direct offset, struck a flow of 100 to 150 bbls. a day at 1,870-75 feet. The Pinder well was found to be only 1,864 feet deep. It came in with a rush at 1,872 feet and was estimated good for 25 to 50 bbls. an hour, or about 500 bbls. a day.

Another surprise came when T. F. Caldwell's No. 1 on the County Fair Grounds, Section 19-22n-2e, West Branch Township, Ogemaw County, made 240 bbls. in 24 hours after acid treatment for a show in the Dundee and was estimated good for at least 150 bbls. a day. Success in the Caldwell test already has increased interest in several deepening projects on previously unsuccessful Traverse wells and is expected to result in further drilling.

C. A. Perry's No. 1 Wobig heirs, Section 6, Mills Township, was shut down to test a show about 100 feet in the Dundee. About half a dozen other wells shut down in the Traverse are to be deepened to the Dundee.

Porter-Midland

More than 3,500 bbls. of additional production was added by new completions and acid tested wells in the Porter Township, Midland County, Pool. Gordon Oil Co. and Columbia Oil & Gas Co.'s No. 4 Minnie Hale, SE SW SW Section 21-13n-1w, Porter Township, Midland County, topped the Dundee limestone at 3,375 feet and drilled to 3,432 feet for a flow of about 1,800 bbls. a day after acid treatment. Davis Oil Co.'s No. 8 Herman Neitzke, NW NW NW Section 21, Porter Township, Midland County, made 3,500 bbls. a day, or 1,700 bbls. a day more than original estimates when first drilled into the Dundee limestone. Pure Oil Co.'s No. 2 G. J. Huff, SE SE SE Section 15, same township, made 46½ bbls. in eight hours for an estimated 125 bbls. a day natural in the Dundee topped at 3,350 feet and completed at 3,407 feet.

Fred Turner's No. 1 Magill, NE NE NE Section 28, Porter Township, was increased from a small 10-bbl. initial producer to at least 30 bbls. a day by drilling 7½ feet deeper. Pure's No. 5 Everett Kleinhans, SW SW NE Section 20, Porter Township, made a flow of 19 bbls. at 3,436 feet and was shut down to be treated. Two other recently treated wells showed good increases: Charles W. Teater's No. 5 Wale, Section 22,, good for 360 bbls. after treatment, and J. S. Braden's No. 3 McCallum, Section 20, increased from 85 to 2,500 bbls. a day. Only three of 30 other active tests in Porter, Greendale and Jasper Townships, of Midland County, were nearing completion in the Dundee as the week closed.

Pure Oil Co. has decided to produce its No. 9 Mina C. Naramore, SW NE SE Section 16, Porter Township, at least temporarily as a 150-bbl. upper Traverse well.

Isabella County

Two Dundee tests were completed in Vernon Township, Isabella County, with disappointing results. J. V. Wicklund's No. 1 Peter Flood, NW NE SW Section 15-16n-4w, Vernon Township, Isabella County, topped the Dundee at 3,830 feet and was shut down at 3,832 feet to test a show of oil and gas. Park Oil Co.'s No. 1 Russell, NW NE NW Section 22, same township, was dry and abandoned in the Dundee. Two other Vernon tests were nearing the Dundee, with a third reaming for a deeper test of the Sylvania and a fourth in Isabella Township, nearly ready to drill into the Dundee,

Nine gas tests, one about ready to drill into the Michigan series in Broomfield Township, were drilling in Isabella County. Two are being started in Deerfield Township, six others drilling in Broomfield Township, while two are drilling in Sherman Township, with a third rigging and a fourth to be started immediately. One gas test also is drilling in Vernon Township. Montcalm and Mecosta Counties also are coming in for an increased search for natural gas.

Five tests are drilling and a sixth soon will be started in Mecosta County.

Three of 12 active tests in Montcalm County were nearing possible pay sands, two in the Dundee and the third in the Michigan gas sands.

Daily Oil Co. continued to treat its No. 3 H. P. Christensen, in Section 8, Home Township, in the hopes of completing it as another upper Traverse oil producer in the Home Township Pool. It made about 50 bbls. swabbing but showed considerable water.

Michigan Cities Natural Gas Co. was reported to have let contracts for 10 tests of its acreage, principally in Broomfield Township, Isabella County, where it is now drilling three gas tests. Formerly the Isabella Development Co., Michigan Cities plans a $250,000 drilling campaign.

It was also reported a Windsor, Canada, operating company is planning to drill eight wells in Michigan fields soon.

Golden Oil Co. has been organized by Greenville and Belding men to drill in the southwest part of Montcalm County on a block of about 4,000 acres along the Flat River Valley, north of Greenville in Pine and Montcalm Townships. Officers are: President, Hubert S. Ellis, Belding; vice president, R. A. Brown, Greenville; secretary, Arthur M. Cook, and treasurer, A. Busk, both of Belding.

Meeting of Operators

Four-fold program of the Independent Petroleum Association of America was outlined before 200 Michigan operators and members of the Oil and Gas Association of Michigan in Mount Pleasant last week by Col. H. B. Fell, executive vice president.

The program is: Limitation of domestic production; limitation of importation; orderly development of new pools, and limitation of withdrawal from storage.

"If importations of foreign crude were curtailed, it would mean an increase of approximately 2,000 bbls. a day to Michigan alone, according to present state allocations," Mr. Fell said.

He also urged the necessity of fighting excessive gasoline taxes which he said "ultimately results in a lower price to the producer or a higher price to the consumer."

He questioned the benefits of Federal regulation as compared with previous state regulation and decried factors tending to force refineries to operate at less than capacity as another cause of lower profits to the producers.

He was introduced by Dr. Virgil R. D. Kirkham, Saginaw geologist and vice president of the Michigan association. He also spoke in Saginaw and conferred with Rep. Carl E. Mapes of Grand Rapids, member of the congressional committee investigating the oil situation.

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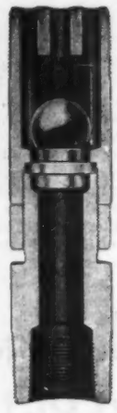

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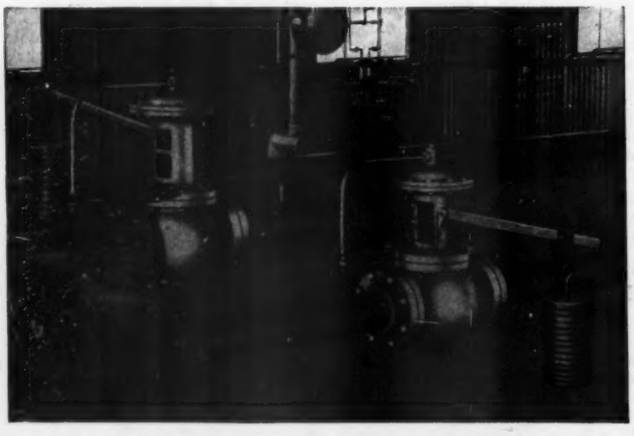

THE illustration shows two C-F Regulators, the larger for winter use when loads are heavy, the smaller for use in summer.

Double settings of C-F Regulators are not uncommon in border stations. They assure smooth and accurate control of either high or lower pressures, whether flow is constant or fluctuating, enlarged or reduced.

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53,000 feet of gas, natural, at 2,112 feet. It is on Tanner Creek.

In Kanawha County, Godfrey L. Cabot, Inc., completed No. 44 on the Arabella D. Huntington lease in Cabin Creek district in the Big Lime at 2,183 feet. It is showing for a small gas well. In Poca district Ward Gas Co. completed drilling deeper the test on the D. W. Hunt farm and it is a small gas well at 2,270 feet. There was no Berea sand.

In Monongalia County, Harry L. Tennant completed No. 5 on the Wise-Tennant lease in Battelle district in the Gordon sand at a depth of 3,400 feet. The top of the Gordon sand was at 3,380 feet and gas showed at 3,400 feet. It gauges 237,600 feet a day.

In Ritchie County, on the waters of Sheep Run in Grant district, H. N. Rinehart drilled on the Doctor Showalters and R. Barnes heirs lease to a depth of 1,960 feet, the Squaw sand. It was dry.

In Wirt County, on Parrish Fork in Clay district, Selman and Whitecotton drilled No. 8 on the J. C. Hale farm through the Salt sand and it was dry.

Drilling in West Virginia

In Boone County, Pure Oil Co. has four wells drilling in Sherman district. No. 58 on the Federal Coal Co. tract is down 2,218 feet; the second test on the Lafollette, Robson and Prichard, Tract C, is drilling at 1,918 feet; No. 260 on the Williams Coal Co. lease has reached 2,178 feet, and the second test on the A. M. Prichard farm is down 1,284 feet. In this district, Godfrey L. Cabot, Inc., is drilling deeper No. 2 on the Mary Dickinson farm and has reached 2,990 feet. His No. 3 on the Central Trust Co. lease has reached 2,543 feet. In Washington district, Pond Fork Oil & Gas Co. is down 1,560 feet on the Cole and Crane lease, No. 18.

In Cabell County, only three wells are actively drilling. In Barboursville district United Fuel Gas Co. has reached 1,310 feet on the J. W. Starkey lease. In McComas district, H. H. Baker Gas Co. is down 1,575 feet on the Augusta Beckett lease, No. 2. West Virginia Gas Co. is drilling at 1,925 feet on the Alifair Adkins farm, a test, and in the same district.

In Calhoun County, Jarvis and Ayers have started drilling on the Roanna Robinson farm in Lee district. F. F. McIntosh is down 625 feet in No. 5 on the Mary E. Hays farm. In Washington district, Ohio Valley Gas Corp. is down 2,050 feet on the N. L. Norman farm. Carroll and Hamilton are drilling at 1,730 feet on the Carl and Robert Knotts farm, a test. Jackson and Bowers have reached 1,000 feet on the Charles White farm. Eastern State Gas Co. is down 850 feet in a second test on the Albert Wilson farm. In Sherman district, Godfrey L. Cabot, Inc., reached 2,690 feet in drilling deeper No. 9 on the W. T. Rafferty farm and shut down testing. The Carnegie Natural Gas Co. is down 1,500 feet in No. 3 on the R. F. Bennett farm. Kenny M. Hunt and others are close to the Injun sand on the Glen Wilson farm. L. P. Bickel has a rig standing for No. 15 on the Martha Stump heirs farm. In Sheridan district, Richter Oil Co. is drilling at 750 feet on the Z. O. Cooper farm, No. 5. A. Rothwell and others have reached 1,500 feet on the Ernest and Edith Marshall farm, a test. In Washington district W. B. Reed and others have made a location on the Curtis and Ella May farm.

In Doddridge County W. D. Gribble is drilling a second test on the M. J. Smith farm in McClellan district and has reached 1,300 feet.

In Gilmer County, Center district, Dotson Norman and others have shut down testing gas in the Salt sand at 1,265 feet on the Bud Stump and others farm. The Hope Construction & Refining Co. is down 900 feet on the A. H. Blackshere farm. V. M. Stewart and others have made a location on the S. P. Miller farm. McCall Drilling Co. is down 1,655 feet on the M. S. Cawthorn farm. West Virginia Utilities Corp. has material on the John J. Gerwig lease.

In Kanawha County Godfrey L. Cabot, Inc., has four wells drilling. In Cabin Creek district, No. 45 on the A. D. Huntington lease is down 1,912 feet and No. 46 has reached 1,213 feet. In Malden district, No. 7 on the Campbells Creek Coal Co. lease is drilling at 2,003 feet and No. 6 on the W. P. Tompkins farm at 2,326 feet. In Elk district, Valley Gas Co. has the material for a second test on the G. W. Harless farm.

In Lewis County, McCall Drilling Co. has the drilling machine ready to start drilling on the Jesse B. Wiseman farm in Freemans district. It is 300 feet north of the test on the J. S. Davis farm.

In Lincoln County, United Fuel Gas Co. has started drilling deeper No. 2,074 on the Charlotte Watson farm in Sheridan district. The depth is now 2,200 feet. In Jefferson district, David Gas Co. has reached 1,410 feet on the T. W. Dolan farm. In Carroll district, R. H. Adkins and others are drilling at 600 feet on the Henry Huffman farm.

In Monongalia County, Martin Oil & Gas Co. is drilling at 475 feet on the David Lemley farm in Cass district. In Clay district, Chartiers Oil Co. has reached 2,361 feet on the Simon Shriver heirs farm. In Clay district, Pedlar Run Oil & Gas Co. is fishing at 2,660 feet for the tools on the Lewis R. Hess farm. In this district on Little Indian Creek, a local company has a rig completed on the Clark Yost farm.

In Ritchie County, in Lost Run Pool in Clay district, Lucky Strike Oil Co. has completed a rig on the A. R. Daugherty farm. The location is about 500 feet northeast of the test on the J. L. and S. C. Robinson farm.

In Roane County, Everett Starcher and others have started spudding on the J. N. Harold farm in Geary district. In this district United Fuel Gas Co. is down 1,075 feet on the S. C. Ross farm. In Roane County O. G. Epling is skidding a rig on the L. P. Starr farm. In Reedy district Law and Leeton have reached 1,810 feet on the O. M. Tatterson farm, a test. In Smithfield district Howard Bartlett and others are drilling at 1,550 feet on the Anna Brannon and others lease. Guy Boggess and others are down 1,565 feet on the O. M. Young farm.

In Wetzel County, Rawe Brothers are drilling on the Evan Morgan farm in Green district and have reached 1,400 feet. In Proctor district, G. N. Yoho and others are down 2,305 feet on the J. W. Monroe farm and have a rig on the George A. Smith farm. C. B. Lewis and others are hauling in the tools on the John Blatt farm, same district.

In Wood County, Roberts and Pepper have started drilling on the John Roberts farm in Walker district. In Williams district, Hartman and Love reached 1,300 feet and shut down on the Ben Mayo farm, a test. Athey Oil Co. is fishing at 765 feet on the D. W. Chichester farm, also a test.

SOUTHWEST PENNSYLVANIA

There were no completions in Southwest Pennsylvania. In Greene County, Fred Garrison drilled a test on the Henderson Coal Co. lease through the Dunkard sand to 550 feet. It was dry.

In Amwell Township, Washington County, Carnegie Natural Gas Co. reached the top of the Fifth sand at 3,054 feet on the N. B. Redd farm and shut down waiting for the cement to harden. Its test on the C. W. Farabee farm is drilling at 2,000 feet. The top of the Big Injun sand was at 1,828 feet. On its A. M. Cole lease, the depth is now 510 feet.

In South Franklin Township, Washington County, Carnegie Natural Gas Co. is deepening No. 1 on the C. T. Dodds farm to the lower pay of the Fifth sand. The top of the Fifth sand was at 2,994 feet with the first oil pay at 2,995-97 feet and showing for 60 bbls. a day from that formation. On this line of production Dusquesne Gas Co. is drilling deeper its No. 1 on the John Day farm. The depth was 2,782 feet and is now 2,802 feet. Union Gasoline & Oil Corp. is spudding on the J. S. Hazlett farm. Furman Nuss & Co. have started drilling a second test on the Jason

Buchanan farm; No. 1 made a poor showing. George Bungard & Co. have started drilling No. 6 on the John G. Clark farm.

In East Findley Township, Washington County, Union Gasoline & Oil Corp. is drilling No. 4 on the Sarah Carter farm and has reached 1,220 feet. The Pittsburgh Coal was at 550 feet.

In Greene County Carnegie Natural Gas Co. has reached 3,165 feet in No. 1 on the E. D. Patterson farm in Perry Township, which is being drilled deeper. In Center Township, J. B. Orndoff has shut down at 2,995 feet on the W. H. Scott farm and is cementing a cave. In Green Township, Equitable Gas Co. is starting to drill deeper No. 1 on the C. F. Stoneking farm from the Bayard Stray sand at 2,977 feet down to the Elizabeth sand. New Oil & Gas Co. is down 765 feet in the test on the J. F. Wilson farm. Greene County Gas Co. has reached 1,651 feet in drilling deeper No. 1 on the Stephen Crane farm.

In Jefferson Township, Fayette County, Carnegie Natural Gas Co. has reached 2,760 feet on the George N. Boyd farm. There was a show of gas in practically every formation.

Wildcat Operations on Gulf Coast

(Continued from Page 308)

Yount Lee Oil Co.'s No. 25 Chambers County, 75 ft. S, 50 ft. W of NE cor. of lease Salt 1,457 ft.; top salt 1,454 ft.

Yount Lee Oil Co.'s No. 26 Chambers County, 50 ft. N of S line and in line with Chambers Co.'s No. 2 and Sun's No. 9 Chambers.
Drlg. cap rock 1,640 ft.

Yount Lee Oil Co.'s No. 27 Chambers Co., 400 ft. W of No. 24 and in line with Nos 24 and 21.
Derrick.

Yount Lee Oil Co.'s No. 28 Chambers County, 50 ft. N S line, direct offset to Sun's No. 10 Chambers County, Wm. Bloodgood Sur.
Derrick.

Yount Lee Oil Co.'s No. 7 Phillips.
T.D. 5,126 ft.; comp. pumping 80 bbls. fluid, 8 per cent water.

Yount Lee Oil Co.'s No. 9 Phillips, 100 ft W of No. 8.
Rig.

BLUE RIDGE—FORT BEND COUNTY

Mills Bennett Prod. Co.'s No. 2 Luscher, 1,950 ft. S and 750 ft. E of westerly NW cor. 500-ac. tract, Thos. Hebermaches Sur.
Drlg. shale and boulders 1,690 ft.

San Jacinto Oil Co.'s No. 4 Blakley, 2,46[illegible] ft. W of E line, 190 ft. S of N line of Edwards Drew Sur
Comp. 40 bbls. 4,032 ft.

BOLING—FORT BEND COUNTY

Trans-State Oil Co.'s No. 1 Joseph Fojtek, NE cor. of 68.29-acre tract, ½ mile W of new discovery.
Drlg. shale 2,529 ft.

RABBS RIDGE—FORT BEND COUNTY

Gulf Prod. Co.'s No. 7-A Mary Gubble, 970 ft. S and 300 ft. W of NE cor. of 120-ac tract No. 3, in Sam Kennedy Sur
Comp. 216 bbls. daily, ⅝-in. choke, 5,387 ft.

Humble-Gulf's No. 28-A Lockwood & Sharp, 379 ft. from S line and 2,872 ft. from E line of "A" lease in J. Rabb Sur.
Coring sand 5,319 ft.

Humble-Gulf's No. 29-A Lockwood & Sharp Location.

Humble-Gulf's No. 30-A Lockwood & Charp 4,296 ft. W of E line and 293 ft. S of N line of lease in J. Rabb Sur.
Derrick.

Humble-Gulf's No. 31-A Lockwood & Sharp, 5,170 ft. W of E line and 292 ft. S of N line of lease in J Rabb Sur.
Derrick

Humble-Gulf's No. 32-A Lockwood & Sharp, 6,391 ft. W of E line and 293 ft. S of N line of lease and 1,149 ft. W of No. 31-A in J. Rabb Sur.
Derrick.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 40 Moore.
Sand, T.D. 4,148 ft.; cmtd. 7-in. csg.

HIGH ISLAND—GALVESTON COUNTY

Yount Lee Oil Co.'s No. 4 Broussard & Orme, M. Dunman Sur., 129 ft. SW of No. 3
No report.

Yount Lee Oil Co.'s No. 41 Cade, Fitzsimmons Sur.
No report.

Yount Lee Oil Co.'s No. 40 Cade, 430 ft NW of No. 3-B, 360 ft. from E line of lease and in line with No. 39 and No. 3-B Fitzsimmons Sur.
No report.

Yount Lee Oil Co.'s No. 22 Smith.
No report.

Yount Lee Oil Co.'s No. 42 Cade, N. Fitzsimmons Sur., half way between Nos. 36 and 28 and 150 ft. E at right angles.
Derrick.

Yount Lee Oil Co.'s No. 1 Maco Stewart, Martin Dunman Sur
Drlg. sand and lime 2,150 ft.

ARRIOLA—HARDIN COUNTY

Republic-Houston's No. 2-X Arriola fee.
T.D. 6,290 ft.; P.B. 4,790 ft.; set screen 4,832 ft.; swabbing.

Republic-Houston's No. 3-X Arriola fee, 2,150.7 ft. S of N line of lease and 150 ft. E of W line of Unit No. X or 400 ft. E of Republic's No. 6 Arriola fee in E. Arriola.
Derrick; waiting on water well.

Republic-Houston Oil Co.'s No. 5 fee.
T.D. 4,420 ft.; fishing stuck drill stem.

SARATOGA—HARDIN COUNTY

Hines Bros.' No. 1 Coswell.
T.D. 3,080 ft.; S.D.

Rio Bravo Oil Co.'s No. 4 E. Jordit, 300 ft. due W of No. 109 Jordit.
T.D. 1,313 ft.; comp. 30 bbls. net oil, 168 bbls. water.

SOUR LAKE—HARDIN COUNTY

Alpha Pet. Co.'s No. 1 J. M. Weiss, 122 ft. S of Steinberger's No. 1 Weiss in Blk. 35.
T.D. 7,012 ft.; abnd.

Alpha Pet. Co.'s No. 2 Weiss estate, 66 ft. N and 100 ft. W from SE cor. of 5-ac. tract in Lot 25, H. Williams Sur. Location.

Humble O. & R. Co.'s No. 1 Kirby et al, 140 ft. E W line and 300 ft. S N line of old Gulf 170-ac. tract, S. Jackson Sur.
T.D. 5,765 ft.; P.B. 5,456 ft.; W.O.C.

Steinberger Pet. Co.'s No. 1 Weiss, 150 ft. W of Parr No. 1 and 50 ft. out of SE cor. of Blk. 28, H. B. Williams Sur.
Location.

Texas Co.'s No. 310 fee, 400 ft. N and 60 ft. E of No. 308 fee.
T.D. 1,831 ft.; cmtd. 7-in. csg. 1,792 ft.

GOOSE CREEK—HARRIS COUNTY

Herring's No. 1 Williams, 180 ft. from SE cor. and 55 ft. NE of Hybush's No. 3, in W. Scott upper league.
Cellar.

Humble O. & R. Co.'s No. 80 Simms-Smith.
Drlg. shale 4,769 ft.

HUMBLE—HARRIS COUNTY

Imperator Oil Co.'s No. 1 N. N. Lee, 400 ft. from E line and 150 ft. from N line of 88-ac. tract in E. Ruhl Sur.
T.D. 3,718 ft.; stuck drill pipe at 2,800 ft.

Wilson Oil Co.'s No. 1 Wilson, 400 ft. from E line and 600 ft. from S line of Mary Owens Sur.
Location.

MYKAWA—HARRIS COUNTY

Danciger Oil & Ref. Co.'s No. 1 Minitex, 300 ft. due E of Framer's No. 1 in NW cor. of Subd. No. 255, J. Lovett Sur
T.D. 4,005 ft.; blew out est. 50,000,000 to 75,000,000 ft. dry gas; junked and abnd.

PIERCE JUNCTION—HARRIS COUNTY

Benedum & Trees' No. 1 W. J. Settegast, 3,629 ft. from S line of Sur., and 100 ft. from E line of tract in the J. Kopman Sur.
T.D. 5,905 ft.; cmtd. csg. 5,760 ft.

D. B. Cogswell's No. 1 Herman Hospital, 525 ft. W of NE cor., 200 ft. S of line of lease in J. Kopman Sur. No. A-195.
Derrick.

Hamil & Smith's No. 2 Humble fee, 413 ft. from W line and 140 ft. S of Hamil & Smith's Gulf fee No. 2, B.B.B.&C. Sur A-179.
T.D. 3,388 ft.; comp. 200 bbls. per day.

Navarro Oil Co.'s No. 2-A Cain, James Hamilton Sur. No. 98.
To work over, 4,947 ft.

Navarro Oil Co.'s No. 2-B Cain, James Hamilton Sur. No. 98.
To work over, 5,292 ft.

Rio Bravo Oil Corp.'s No. 9-A Settegast, 1,575 ft. N line, 350 ft. E line NE cor. "A" lease, J. A. Kopman Sur.
T.D. 4,510 f..; standing.

Rio Bravo Oil Corp.'s No. 12-A Settegast, 1,410 ft. N line, 650 ft. E line, J. A. Kopman Sur.
Shale 5,933 ft.; S.D.

TOMBALL—HARRIS COUNTY

Amerada-Rycade's No. 1-A Metzler, J. House Sur.
Sand 5,580-85 ft.; cmtd. 7-in. csg. 5,577 ft.

Amerada-Stanolind's No. 5 Otto-Rudel, 500 ft. E line 50-ac. lease in J. House Sur.
Rigging up.

Continental Oil Co.'s No. 2 Petrich, 1,900 ft. from S line and 157 ft. from E line of 50-acre tract.
Drlg. shale and lime 3,359 ft.

Humble O. & R. Co.'s No. 2 Erwin.
Drlg. shale 5,266 ft.

Humble Oil & Ref. Co.'s No. 1 Christine Holderreith, 377 ft. from N line and 466 ft. from E line of most northerly NE cor. of 85-acre tract in J. House Sur.
Location.

Humble O. & R. Co.'s No. 1 John Holderreith, 500 ft. S line, 495 ft. E and W lines of 112.5-ac. lease, C. W. Pillot Sur. No. 832.
Derrick.

Humble Oil & Ref. Co.'s No. 1 Kieb, 900 ft. from S line and 741 ft. from W line of 97-acre tract in W. Heard Sur.
T.D. 5,604 ft.; P.B. 5,560 ft.; drlg. cmt. to 5,584 ft.; perforated 5,582-72 ft. and 5,525-50 ft.; set 61 ft. screen; comp. 1,512,000 ft gas; T.P. and C.P. 1,500 lbs.

Humble O. & R. Co.'s No. 1 Otis F. Laird, 300 ft. from S line and 473 ft. from W line of 24-acre lease in C. N. Pillot Sur.
Drlg. shale 961 ft.

Humble-Magnolia's No. 1 R. Irvine, 2,113 ft. from S line and 366 f.. from E line of 202.3-acre lease in J. House A-24.
Sand 5,555-66 ft.; comp. 456 bbls. oil and 1,017,000 ft. gas; T.P. 1,500 lbs.

Humble O. & R. Co.'s No. 2 Krahn, Wm. Hurd Sur. 377.
Drlg. shale 1,613 ft.

Humble-Magnolia's No. 1 Krug, 660 ft. N and 187 ft. E from SW cor. of J. F. W Koba. 30.6-ac. tract in J H. Edwards Sur Location.

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Humble-Magnolia's No. 2 Krug, 466 ft. from E line of lease and 800 f... S of S line of Sherer 112-ac. tract in J. H. Edwards Sur.
Location.
Hum le O. & R. Co.'s No. 3 Rudel-Oster, J. House Sur.
Drlg. hard lime 3,214 ft.
Humble O. & R. Co.'s No. 1 E. B. Johlke, Joseph House Sur.
Rigging up.
Texas Co.'s No. 3 Hirsch, 466 ft. W of E line and 100 ft. N of S line of lease
T.D. in sand 5,594 ft.; drlg. 7-in. plug 5,581 ft.

FANNETTE—JEFFERSON COUNTY

Gulf Prod. Co.'s No. 3 Junker, 700 ft. W, 350 ft. S of NE cor. of 260-ac. tract, W. H. Smith league.
Drlg. lime, shell and shale 5,074 ft.
Gulf Prod. Co.'s No. 15 Thomas, 200 ft. W of Gulf's No. 7 Burrell.
Derrick.

CLEVELAND—LIBERTY COUNTY

Gulf Prod. Co.'s No. 5-C Kirby, 944 ft. W, 500 ft. S of No. 4-C in the J. Pleasant Sur.
Drlg. shale 5,361 ft.

ESPERSON—LIBERTY COUNTY

General Crude's No. 13 Moore's Bluff, 450 ft. W of E line and 2,100 ft. S of N line of lease and 1,000 ft. N of No. 12.
Drlg. hard sandy lime 3,385 ft.
General Crude Oil Co.'s No. 9 Davis, 1,200 ft. each way from S and E lines of lease in D. Kokernut Sur.
Drlg. shale 1,872 ft.

HANKAMER—LIBERTY COUNTY

George Devore et al's No. 1 S. E. Exell, 175 ft. S of Gulf's No. 1 and 165 ft. from E line of 175-ac. lease in Levi Barrow Sur
Drlg. 1,120 ft.
Mirimar Oil Co.'s No. 2 Crow & Jacobs, H. &T.C. Sur. No. 21.
S.W. sand 6,084 ft.; abnd.

HULL—LIBERTY COUNTY

Flynn's No. 1 Flynn, J. Devore Sur.
T.D. 1,517 ft.; S.D.
Gulf Prod. Co.'s No. 104 Phoenix, 2,479 ft from W line and 1,115 ft. from S line of 300-ac. tract in J. Devore Sur.
Drlg. sandy shale 4,875 ft.
G. R. Brown and S. F. Bashara's No. 1 David Hannah, Jesse Devore league, 100 ft. S line, 150 ft. E line, 42-ac. Gulf tract.
Derrick.
Gulf Prod. Co.'s No. 105 Phoenix, 1,154 ft. N, 200 ft. W of SE cor. of 300-acre tract in Jesse Devore Sur.
Clearing location.
Republic Prod. Co.'s No. 153 Dolbear, 400 ft N and 45 deg E. from No. 151, in the J Devore Sur.
No report.
Sun Oil Co.'s No. 9-A Carr, 333 ft. from N line and 307 ft. from W line of lease in J. Devore Sur.
Sandy shale, S.O., 4,514 ft.
Texas Co.'s No. 9 Hannah, 350 ft. N and 300 ft. W of No. 5 Hannah.
Drlg. sand and shale 3,740 ft.

LIBERTY COUNTY

Texas Co.'s No. 22 Staiti, 350 ft. S and 50 ft. E of No. 14.
Drlg. hard sand rock 689 ft.

MARKHAM—MATAGORDA COUNTY

Hawkins Oil Co.'s No. 1 Hawks fee, 1,350 ft. from N line and 1,650 ft. from E line of 20-ac. lease.
T.D. 600 ft.; derrick down.
Powers Prod. Co.'s No. 4 Myers, in line with wells Nos. 1 and 3, being 250 ft. E of No. 2.
Derrick down.
Rio Bravo Oil Co.'s No. 1 Sisk, 550 ft. N, 650 ft. W SE cor. of R. J. Sisk's 158-ac. tract in Lot 2, Wm. Haddon league.
T.D. 3,431 ft.; W.O.C.; 7-in. csg. cmtd. 3,393 ft.
VAN VLECK—MATAGORDA COUNTY
Skelly Oil Co.'s No. 2 F. G. Cobb, 1,185 ft. E of W line and 2,515 ft. N of S line of F. G. Cobb lease in Marie Cummings Sur.
Drlg. shale 1,322 ft.

CONROE—MONTGOMERY COUNTY

Alpha Pet. Co.'s No. 1 Hensley, 466 ft. from N and W lines of 25-acre lease in A. Steele Sur.
Sand 5,095 ft.; running csg.
Cameron & Cameron's No. 1 Dudley, S offset to S.rake's No. 1 Hammond.
Moving in.
Gulf Coast Drlg. & Prod. Co.'s No. 3 J. L. Hensley, 667 ft. from No. 2 and midway between E and W lines of lease in A. Steele Sur.
T.D. 5,089 ft.; comp. 50 bbls. per hour, ⅛-in. choke.
Humble O. & R. Co.'s No. 6 B. D. Griffin.
Drlg. shale 3,200 ft.
Humble O. & R. Co.'s No. 42 Madeley.
T.D. 5,100 ft.; cmtd. csg.
Strake Oil Co.'s No. 1-B Dean, offset to Tide Water-Strake No. 8 Dean.
T.D. 5,095 ft.; cmtd. csg.
Sun Oil Co.'s No. 20 Keystone Mills, 1,455 ft. E and W line and 466 ft. N and S line of lease.
Drlg. shale and lime 2,409 ft.
Sun Oil Co.'s No. 2 South Texas, 943 ft. N of No. 1 and in center of lease E and W in T.&N.O. Sur. No. 5.
T.D. 5,153 ft.; tested S.W.; standing.

ORANGE—ORANGE COUNTY

Trio Oil Co.'s No. 1 D. S. Comer, 69 ft. W of E line and 39 ft. S of N line of 6.33-ac. tract in W. M. Dyson Sur.
No report.

PORT NECHES—ORANGE COUNTY

Texas Co.'s No. 8 Kuhn, 1,320 ft. N and 250 ft. E of SE cor. of Mary E. Hall Sur. No. 2 in T. J. Notgrass Sur.
Rig.
Texas Co.'s No. 9 Kuhn, 990 ft. N and W of SE cor. of Mary E. Hall Sur. No. 2.
Dredging canal to location.
Texas Co.'s No. 2-B Polk, 695 ft. N, 150 ft S of NE cor. of N. Jacob Beaumont Sur
T.D. 6,708 ft.; sidetracking 5,835 ft., shale.

LIVINGSTON—POLK COUNTY

T. D. Humphries' No. 1 P. E. Orton, 330 ft. from S and W lines of 40-acre tract in A. Viesca Sur.
Abnd. 4,338 ft.
T. D. Humphries' No. 1 J. C. Whitforth, Block H.
Derrick.
J. Z. Werby's No. 2 Dick & Failing, A. Viesca Sur.
T.D. 4,334 ft.; comp. flowing 12 bbls. first 4 hrs., ¼-in. choke, T.P. 1,340 lbs., C.P. 1,630 lbs.
J. Z. Werby et al's No. 3 Dick & Failing, 330 ft. from SW line of 160-ac. tract, A. Viesca Sur.
Rigging up.

GRETA—REFUGIO COUNTY

Atlantic and Stanolind's No. 5 G. O'Brien, 2,720 ft. N of most easterly SE cor. of 400-acre lease, 466 ft. W of E line in Winfield Sur.
Drlg. shale 947 ft.
Circle W Oil Co.'s No. 11 J. M. O'Brien, Crunk Sur.
Location.
Floboots Oil Co.'s No. 3 E. O'Brien, 466 ft. from S line and 503 ft. from E line of E. H. Winfield Sur., Block 33.
Drlg. rock 3,990 ft.
Floboots Oil Co.'s No. 4-E O'Brien, 466 ft. from S line and 503 ft. from E line of Winfield Sur., Block No. 33.
Shale 4,355 ft.
Floboots Oil Co.'s No. 3-F O'Brien, 466 ft. from S and E lines of Block No. 35 in Peoples Survey.
T.D. 4,388 ft.; comp. 125 bbls., 14/64-in. choke, T.P. 440 lbs., C.P. 660 lbs.
Hewitt & Daugherty's No. 9 M. F. Lambert, 466 ft. from N line and midway between E and W lines of Blk. 16, Hardwick Sur.
Drlg. shale 3,525 ft.
Hewitt & Daugherty's No. 10 M. F. Lambert, midway between E and W lines of Hardwick Sur., 466 ft. S line, Blk. 343.28-ac. tract.
Rigging up.
Houston Oil Co.'s No. 15 Heard, 660 ft. SE of No. 14 and 330 ft. NE of S line of lease.
Drlg. sticky shale 3,847 ft.
Houston Oil Co.'s No. 15 F. B. Rooke, from SE cor. of lease 806 ft. N along E line, thence 150 ft. W at R/A in Mullin Sur.
T.D. 4,935 ft.; comp. 450 lbs. per day, ⅝-in. choke, 360 lbs. W.P. on tubing, 725 lbs. pressure on csg.; shut in.
Houston Oil Co.'s No. 6 M. H. Ryals, 1,050 ft. from N line and center of E and W lines of lease.
Drlg. sticky shale 5,110 ft.
Humble Oil & Ref. Co.'s No. 6 Fannie Heard, 1,499 ft. N line and 503 ft. W line of 337-acre tract in Ximines Sur.
Drlg. shale 2,160 ft.
Humble O. & R. Co.'s No. 7 Fannie Heard, Ximines Sur., 2,438 f.. S of most northerly N line, 2,472 ft. E line 337.14-ac. tract.
Drlg. clay 84 ft.
Humble Oil & Ref. Co.'s No. 9 J. F. B. Heard, 833 ft. N of No. 8 and 1,399 ft. E of lease line in Peoples Sur.
T.D. 4,384 ft.; comp. 920 bbls., ⅝-in. choke, T.P. 500 lbs., C.P. 700 lbs.
Stanolind O. & G. Co.'s No. 3 J. M. O'Brien, Peoples Sur.
Moving in rig.
Stanolind O. & G. Co.'s No. 3-A J. M. O'Brien, Peoples Sur., begin at NE cor. of "A" lease, thence W along N line 1,509 ft.; thence S at right angles 466 ft.; S offset to No. 4-B.
S.D. 4,384 ft.
United Prod. Co.'s No. 7 W. T. Fox, 695 ft. SE of No. 6.
T.D. 4,395 ft.; P.B. 3,515 ft.; comp. 190 bbls. per day, ¼-in. choke, T.P. 750 lbs., C.P. 900 lbs.
United Prod. Co.'s No. 7 Wilson Heard, 331 ft. S of No. 5.
T.D. 4,934 ft.; comp. 9 bbls. per hour, ¼-in. choke, T.P. 75 lbs., C.P. 590 lbs.
United Prod. Co.'s No. 8 Wilson Heard, 1,079 ft. SE from most northern point along NE boundary line of lease, thence 330 ft. SW at right angles.
Spudded.
United Prod. Co.'s No. 8 Lambert.
T.D. 4,391 ft.; W.O.C.
United Prod. Co.'s No. 8 J. A. Lambert, 651 ft. N of NW cor. of W. Heard tract and 150 ft. W of tract line.
Drlg. shale 6,040 ft.
United Prod. Co.'s No. 9 Lambert, 466 ft S line and 507 ft. E line of Blk. 17, H.A D. Subd. of Hardwick Sur., Abst. 159.
T.D. 5,170 ft.; cmtd. 5 3/16-in. csg.
United Prod. Co.'s No. 9 Shelly Ryals.
Drlg. shale 6,052 ft.

O'CONNOR—REFUGIO COUNTY

Humble Oil & Ref. Co.'s No. 15 O'Connor N 60 deg. W 933 ft. of No. 4 in Keetins Sur.
Rigging up.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 2 Mrs. A. Draeger, 1,200 ft. E of W line and 800 ft. N of S line of 205-ac. tract in J. F. Perry Sur.
T.D. 1,492 ft.; reaming.

SOUTH LOUISIANA FIELDS

BLACK BAYOU—CAMERON PARISH

Brownie Babbette Oil Co.'s No. 1 R. A Moore, 562 ft. W, 50 ft. S of NE cor. of E½ of SE Sec. 18-12s-12w.
No report.
Shell Pet. Corp.'s No. 3 State.
T.D. 5,584 ft.; to sidetrack bit.
Shell Pet. Corp.'s No. 19 Watkins fee, 1,369 ft. S, 2,185 ft. W of NE cor. Sec. 18-12-12
T.D. 3,897 ft.; comp. 18 bbls. per hour, 13/64-in. choke, T.P. 250 lbs., C.P. 310 lbs.

BAY ST. ELAINE—TERREBONNE PARISH

Texas Co.'s No. 3 State Bay St. Elaine.
Rigging up.

BOSCO—ACADIA AND ST. LANDRY PARISHES

Oswego Oil Co.'s No. 1 Joseph Mouton.
T.D. 1,395 ft.; S.D.
Superior Oil Co.'s No. 1 J. Sidney Arceneaux et al, 1,665 ft. N and 439 ft. W of SE cor of Sec. 3-8s-3e.
Abnd. 3,771 ft.
Superior Oil Prod. Co.'s No. 1 Mrs. Estelle Comeaux and others' 675.6 ft. W and 511.4 ft. S of NE cor. of Sec. 34-8s-3e.
Drlg. sand, shale and lime 3,485 ft.
Superior Oil Producing Co.'s No. 1 Sidney Fall, 542.9 ft. W and 511.4 ft. N of SE cor. Sec. 27-8s-3e.
T.D. 1,250 ft.; cmtd. 13-in. csg.
Superior Oil Prod. Co.'s No. 1 Eddie Prejean (Alex Forrestier), 3,021.3 ft. W and 439.4 ft. S of NE cor. of Sec. 34-8s-3e.
Drlg. sand, 5,357 ft.
Superior Oil Prod. Co.'s No. 1 Adras Guilbeau, 492.6 ft. E and 508.2 ft. S from NW cor. of SW Sec. 26-8s-3e.
Foundation.
Superior Oil Co.'s No. 1 Leo E. Kahan et al 2,381 ft. N and 468 ft. W of SE cor. of Sec. 33-8s-3e.
T.D. 7,745 ft.; backed off pipe to 2,932 ft.; milling on pipe.
Superior Oil Prod. Co.'s No. 1 Walter V. Larcade, 462.4 ft. N and 500.2 ft. S of NW cor. of Sec. 35-8s-3e.
Rig.
Superior Oil Prod. Co.'s No. 1 Euclide LeBlanc, 1,873 ft. S and 673.2 ft. W of NE cor of Sec. 33-8s-3e.
Derrick.
Superior Oil Prod. Cor.'s No. 1 Lucien Lavergne, 596 ft. E and 330 ft. N of SW cor. of Sec. 27-8s-3e.
Moving in material.
Superior Oil Prod. Co.'s No. 1 Moise Lavergne, 269.7 ft. W and 98 ft. N of SE cor. of Sec. 28-8s-3e.
Moving in material.
Superior Oil Prod. Co.'s No. 1 Auguste Martinez, 2,510.6 ft. S and 1,057.2 ft. W of NE cor. of Sec. 35-8s-3e.
Drlg. sand and shale 7,838 ft.
Superior Oil Co.'s No. 1 Leoanstie Richard 2,378 ft. S and 465 ft. W of NE cor. of Sec. 34-8s-3e.
T.D. 8,718 ft., sand; reaming to set csg. at 8,706 ft.
Superior Oil Prod. Co.'s No. 1 Leonard Savole, 814 ft. W and 658 ft. N of SE cor Sec. 26-8s-3e.
Drlg. hard shale 6,021 ft.
Superior Oil Co.'s No. 1 Marcellus Savole 2,201 ft. S and 761 ft. W of NE cor. of Sec. 27-8s-3e.
Drlg. hard shale 8,861 ft.

CAILLOU ISLAND—TERREBONNE PAR.

Texas Co.'s No. 12 State Caillou Island, 2,420 ft. E and 73 ft. S of NW cor. of Sec 20-22s-20e.
Drlg. shale and lime 4,520 ft.

CALCASIEU LAKE—CAMERON PARISH

Texas Co.'s No. 10-A State, 16,855 ft. W and 3,270 ft. N of NE cor. Sec. 1-14s-9w in Twp. 13s-9w.
Salt 6,721-6,870 ft.

CAMERON MEADOWS—CAMERON PAR.

Burton-Sutton Oil Co.'s No. 4 School Land 2,891 ft. W and 150 N of SE cor. of Sec 16-4s-13w.
Derrick.
Texas Co.'s No. 1 Miami Corp.
Drlg. water sand 5,379 ft.

CHOCTAW FIELD—IBERVILLE PARISH

Standard Oil Co. of Louisiana's No. 6 Myrtle Grove Wilbert, Sec. 52-9s-11e.
T.D. 4,414 ft.; comp. 890 bbls. daily.

DOG LAKE—TERREBONNE PARISH

Texas Co.'s No. 16 State Dog Lake, 25 ft. N of No. 1 in Sec. 6-22s-16e.
Salt 1,728-1,882 ft.; abnd.

EDGERLY—CALCASIEU PARISH

Union Sulphur Co.'s No. 2 Hunter, 1,366 ft N 425 ft. W of SE cor. SW Sec. 21-9s-11w
Drlg. shale 4,632 ft.

GARDEN ISLAND—PLAQUEMINES PAR.

Texas Co.'s No. 11 Garden Island, 4,191 ft S and 1,504 ft. W of NE cor. Sec. 107-23s-32e.
Rock 1,872 ft.; comp. gasser, est. 60,000,000 ft., ½-in. choke; shut in.

GUEYDAN—VERMILLION PARISH

Pure Oil Co.'s No. 6, Alliance Trust, 667 ft E, 1,787 ft. S line of lease, Sec. 34-11s-1w
Coring sand 8,552 ft.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 2 Hanszen, 400 ft. W and 200 ft. S of No. 1 in Sec. 14-12s-10w
T.D. 6,462 ft.; sidetracked 4,175 ft.; drlg. sandy lime 5,001 ft.
H. E. Dawton's No. 1 Kaugh.
Abnd. location.
Gulf Ref. Co.'s No. 15-A M. P. Irwin, 363 ft. N and 241 ft. W of the SE cor. of Sec. 12-13-10.
Bldg. derrick.
Wilfred LaHay's No. 1 Roux, Sec. 36-13s-10w.
Shale 3,986 feet.; S. D.
Sutton Oil Co.'s No. 1 Portier, 2,930 ft. W and 1,320 ft. N of SE cor. of Sec. 23-12s-10w.
T.D. 3,230 ft.; comp. 65 bbls. daily.
Texas Co.'s No. 12-B State, 500 ft. SE of No. 10-B or 1,360 ft. E and 149 ft. S of NE cor. of Sec. 13-12s-10w
Drlg. sand and shale 3,557 ft.
Union Sulphur Co.'s No. 1 Barbee est., 1,720 ft. N line, 320 ft. E of SW cor. Sec. 13-12s-10w.
T.D. 7,986 ft.; sidetracking in shale 7,501 ft.
Union Sulphur Co.'s No. 9 Humble, 300 ft. E and slightly N of No. 1 well, or 330 ft N and 270 ft. E of the SW cor. of Sec. 12-12s-10w.
T.D. 6,000 ft., salt; P.B. 5,380 ft.; sidetracked and drlg. rock 5,850 ft.
Yount Yee Oil Co.'s No. 1-A Gulf Land, 2,000 ft. S and 50 ft. E of the NW cor. of Sec. 22-13-10.
Derrick.
Yount Lee Oil Co.'s No. 2-A Gulf Land, 1,100 ft. S and 50 ft. E of the NW cor. of Sec. 21-13-10.
Rig.
Yount Lee Oil Co.'s No. 15-A Gulf Land, 1,160 ft. S and 715 ft. W of the NE cor. of the SW of Section 16-12-10.
Bldg. road.
Yount Lee Oil Co.'s No. 1 John L. Henning, 1,200 ft. N and 975 ft. E of the SW cor. of Sec. 20-12-10.
Cap rock 1,661-64 ft.; abnd.

NEW IBERIA—IBERIA PARISH

A. D. Spell's No. 1 Sadiator, 25 ft. NW of No. 1 in A. B. Bernard Sur., Sec. 54
T.D. in salt 4,200 ft.; D.S. stuck, blew out; bridged over 900 ft.

IOWA—CALCASIEU AND JEFF DAVIS PARISHES

Barnsdall Oil Co.'s No. 2 Caffal.
Set screen 6,974 ft.
Barnsdall Oil Co.'s No. 6 Fontenot, 330 ft. from N and W lines of lease in Sec. 7-8s-6w.
Drlg. plug 7,018 ft..
Magnolia Pet. Co.'s No. 1 Gillson, 330 ft. out of SE cor. of NE Sec. 12-9S-7w, N offset to No. 2 Wait.
T.D. 7,027 ft.; working over.
Magnolia Pet. Co.'s No. 9 Wait, 330 ft. E and S of the C of the lease, and is N of No. 8 Wait.
Rig.
Shell Pet. Corp.'s No. 8 Fontenot, 330 ft. out of NE cor. of lease.
Coring shale 6,925 ft.
Shell Pet. Corp.'s No. 8 Heyd.
T.D. 7,269 ft.; to P.B. to 6,698 ft.; drlg. cement.
Shell Pet. Corp.'s No. 2 C. L. Johnson, 330 ft. out of SE cor. of 80-ac. lease, and offset to Magnolia's No. 6 B. T. Wait.
Coring sticky shale 4,978 ft.
Shell Pet. Corp.'s No. 1 Scott, 330 ft. out of NW cor. of lease.
Drlg. sticky shale 5,907 ft.
Shell Pet. Corp.'s No. 5 Stratford.
Drlg. sand and gravel 610 ft.

JENNINGS—ACADIA PARISH

Yount Lee Oil Co.'s No. 14 Housierre-Latrielle, 260 ft. N of No. 13, Sec. 47-9s-2w.
Drlg. shale 3,820 ft.

LAKE BARRE—TERREBONNE PARISH

Texas Co.'s No. 10 L.L.&E., 4,543 ft. S, 508 ft. W of NW cor. Sec. 30-21s-20e.
T.D. 3,690 ft.; S.D.
Texas Co.'s No. 11 L.L.&E., Sec. 30-21s-20e. Sand 3,769-3,804 ft.; cmtd. csg.
Texas Co.'s No. 12 L.L.&E.
Derrick.
Texas Co.'s No. 24 Lake Barre.
T.D. 3,833 ft.; comp. 1,890 bbls., ¼-in. choke.
Texas Co.'s No. 26 Lake Barre, 150 ft. N from No. 22, Sec. 30-21s-20e.
Drlg. 3,225 ft.

LAKE HERMITAGE—PLAQUEMINES PARISH

Humble O. & R. Co.'s No. 2 LaFourche Basin Levee Dist.
Drlg. hard sandstone 3,232 ft.

LAKE PELTO—TERREBONNE PARISH

Texas Co.'s No. 11 Lake Pelto, 1,660 ft. SW of No. 5.
Drlg. sandy shale 5,300 ft.
Whitestone O. & G. Co.'s No. 1 Buckley, 300 ft. S and E of NW cor. SW SW Sec. 15-19s-16e.
No report.

LAKE WASHINGTON—PLAQUEMINES PARISH

Humble O. & R. Co.'s No. 23 Cockrell-Moran, 650 ft. N and 21 deg. 30 min. E of No. 7 in Twp. 20s-26e.
Dredging canal to location.
Humble O. & R. Co.'s No. 24 Cockrell-Moran, 400 ft. E, 100 ft. S of Freeport Sulphur's No. 11 Cockrell-Moran, SE of Sec. 34-20s-26e.
Shale 163 ft.

LEESVILLE—LAFOURCHE PARISH

Robert Bowles' No. 1 Crosby.
T.D. 4,525 ft.; P.B. 1,800 ft. and drilled to 3,880 ft.; D.S. stuck.
Robert Bowles' No. 2 Crosby.
Derrick.
Emerald Pet. Co.'s No. 7 State of Louisiana.
Derrick.
Gulf Prod. Co.'s No. 8 Bernard, 568 ft. E along S line of 5.08-ac. tract from SW cor. and 446 ft. N at right angles, Sec. 26-21s-22e.
Location.
Emerald Pet. Co.'s No. 8 State of La., 455 ft. N of No. 1.
Drlg. sandy shale 3,963 ft.
Emerald Pet. Co.'s No. 9 State of La., 499 ft. S of No. 1.
Rig.
Emerald Pet. Co.'s No. 10 State, west bank, 300 ft. S of well No. 1.
Location.
Emerald Pet. Co.'s No. 11 State, east bank, 327 ft. N of well No. 1.
Location.
Emerald Pet. Co.'s No. 12 State, east bank, 350 ft. S of well No. 1.
Location.
Gulf Ref. Co.'s No. 7 Bernard, 650 ft. E along S line of 5.08-acre tract and 650 ft. from SW cor. of tract and 46 ft. N at right angles.
Rig.
Frank L. Hill's No. 1 Bernard, 1,422 ft. N and 308 ft. E of SW cor. Sec. 26-21s-22e
No report.
Lincoln Oil Co.'s No. 1 Constantine.
Drlg. shale 5,106 ft.
Texas Co.'s No. 19 L.L.&E., Sec. 27-21s-22e
Drlg. 4,492 ft.
Texas Co.'s No. 20 L.L.&E., Sec. 27-21s-22e
Rigging up.
Texas Co.'s No. 26 L.L.&E.
Drlg. shale 3,999 ft.

LOCKPORT—CALCASIEU PARISH

Magnolia Pet. Co.'s No. 12 Bordages, 966 ft. W and 93 ft. N of SE cor. N½ NE Sec. 8-16s-15w.
No report.
Magnolia Pet. Co.'s No. 22 Miller, 935 ft. E, 480 ft. S of NW cor. of S½ of NW of Sec. 9-16s-9w.
T.D. 4,374 ft.; comp. flowing 300 bbls. daily.

Magnolia Pet. Co.'s No. 34 Miller, Sec. 9-10s-9w.
No report.
George W. Strake's No. 1 Moss, 575 ft. S and 70 ft. W of NE cor. of SW NW Sec. 8-10s-9w.
T.D. 5,914 ft.; fishing stuck drill stem.
Union Sulphur Co.'s No. 1 Farquaher, 200 ft. S and W lines, NE cor. SW SE Sec 36-12s-10w, 2-ac. tract.
Drlg. shale 5,598 ft.
Union Sulphur Co.'s No. 6 Moss, between No. 2 and No. 5.
T.D. 6,650 ft.; comp. flowing 650 bbls. dail.; 1,200 lbs. pressure.

PORT BARRE—ST. LANDRY PARISH

Gulf Ref. Co.'s No. 6 Wilson-Cochran Sand 3,268 ft.; cmtd. csg.
Phillips Pet. Co.'s No. 1 Sibille, 3,062 ft. S from R.R. along W line of Sibille Co., Inc., 180-acre tract and 50 ft. E in Sec. 7-6s-6e. Spudded.
Texas Co.'s No. 21 Botney Bay, 2,400 ft. S, 8 deg. W of most southerly NE cor. of Botney Bay 562-ac. tract, thence 600 ft. N, 82 deg. W. at R/A.
Salt 3,647-3,786 ft.; abnd.

SORRENTO—ASCENSION PARISH

Union Sulphur Co.'s No. 26 United Land
T.D. 5,752 ft.; top salt 5,745 ft.; P.B. to 4,800 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 776 fee.
T.D. 4,892 ft.; P.B. 4,548 ft.; drld. to sand 4,770 ft.; comp. 500 bbls. daily.
Union Sulphur Co.'s No. 794 fee.
Rigging up to pump 5,407 ft.
Union Sulphur Co.'s No 795 fee.
Coring sticky shale 4,232 ft.
Union Sulphur Co.'s No. 796 fee.
Abnd. 2,288 ft.
Union Sulphur Co.'s No. 797 fee, 1,682 ft W. 418 ft. N of C of Sec. 29-9s-10w.
T.D. 3,788 ft.; comp. 650 bbls. daily.
Union Sulphur Co.'s No. 800 fee, 2,296 ft. N and 311 ft. W of C of Sec. 29-9s-10w.
Coring 3,244 ft.
Union Sulphur Co.'s No. 801 fee, 1,862 ft. N, 670 ft. E of C of Sec. 29-9s-10w.
Broken rock 1,724 ft.
Union Sulphur Co.'s No. 802 fee, 908 ft. N, 1,340 ft. E of C of Sec. 29-9s-10w.
Rigging up.
Union Sulphur Co.'s No. 805 fee.
Drlg. sand and gravel 960 ft.
Union Sulphur Co.'s No. 2 Kelly, 1,345 ft. S, 198 ft. W of the NE cor. of Sec. 30-9s-10w.
Set 12½-in. casing at 1,203 ft.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 12 Yount Lee fee, 800 ft. S of No. 11, in line with Nos. 9 and 10 Sec. 12-13-3w.
T.D. 7,439 ft.; temp. S.D.

VINTON—CALCASIEU PARISH

Gulf Ref. Co.'s No. 68 G.N.G.
Moving in rig to work over 3,069 ft.
Tri-Oil Co.'s No. 1 Matilda Gray, 38 ft. W. 35 ft. N of SE cor. NE SW NE Sec. 33-9s-12w.
T.D. 3,630 ft.; S.D.
Vinton Oil Co.'s No. 1 J. G. Gray, 230 ft. from N line and 545 ft. from E line of SE NE Sec. 4-11s-12w.
Derrick.
Vinton Pet. Co.'s No. 2 Mathilda Gray, 100 ft. N of No. 1 and in Sec. 33-10s-12w. (W.O.); T.D. 3,225 ft.; W.O.C.

WHITE CASTLE—IBERVILLE PARISH

Shell Pet. Corp.'s No. 9 Wilburn.
Coring soft sand 5,569 ft.

MISCELLANEOUS WILDCATS

TEXAS

ANGELINA COUNTY

Thayer et al's No. 1 Dearmond, J. T. Peavy Sur., 2½ miles SE of Zavalla.
Hard lime 1,915 ft.; T.D.; F.A.

AUSTIN COUNTY

I.T.I.O. and Johnson Bros.' No. 1 August Wrangler, 450 ft. out of N cor. of Wrangler 132-ac. tract in Adam Kuykendall Sur.
Drlg. shale 3,602 ft.
Humble O. & R. Co.'s No. 4 A. T. McCasland, "X" tract, 1,565 ft. at right angles from N line and 28 ft. NW of No. 1 on 140.75-ac. tract, Wm. White Sur.
Derrick.

BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 1 Houston Farm Dev. Co., 1,414 ft. N, 316 ft. W of SE cor. of L. Bachelder Sur.
Drlg. hard sand 5,647 ft.
Jack Clark tr.'s No. 1 J. M. Spear, 150 ft. from N line and 150 ft. from W line of Lot 4, in Pinckney Sur.
T.D. 5,009 ft.; sand and lime; S.D.
Danciger O. & R. Co.'s No. 3 Hunt, skidded 200 ft. SW of No. 3-A in W. C. Carson Sur.
Drlg. sandy shale 6,620 ft.
Danciger Oil & Ref. Co.'s No. 1 Stark-Brown 330 ft. out of most easterly NE cor. of lease in Perry & Austin Sur.
T.D. 6,935 ft.; dry and abnd.
Dillock Pet. Co.'s No. 1 Frank Truksa, 200 ft. from S and 1,000 ft. from E lines of 75-ac. tract, Sec. 7, H.T.&B.R.R. Sur.
Drlg. 2,780 ft.
Holt et al's No. 1 Griffith, J. B. Bailey Sur
T.D. 4,200 ft.; waiting orders.
Turnbull & Irwin's No. 1 Braden, H.T.&B. Sur., SE of Sec. 50, 4 miles SE of Juliff.
Moving in rig.

BRAZOS COUNTY

Buck Wallace's No. 1 Broach, 1,000 ft. from S line, 400 ft. from W line of 251-ac. tract in G. W. Singleton Sur.
T.D. 369 ft.; S.D.

BURLESON COUNTY

Bear Pond Oil Co.'s No. 1 J. H. Coulter, 9,400 ft. from SW line and 2,200 ft. from NW line of 1,176-ac. tract in SE cor. of county in A. Kennon Sur.
Drlg. hard rock 4,047 ft.

CALHOUN COUNTY

Continental Oil Co.'s No. 1 American Nat Realty Co., C of NE of Sec. 6, Blk. C.
T.D. 5,878 ft.; fishing.
Herman Heep's No. 3 Welder.
Cmtd. surface csg. 695 ft.
Mills Bennett Prod. Co.'s No. 1 R. Adams, C of NW line of Sec. 45.
Drlg. sticky shale 2,100 ft.

CHAMBERS COUNTY

Turnbull & Irwin's No. 1 Sudindorf, center of W line of 483-ac. tract, H.&T.C. Sur. No. 67, due E of Anahuac.
Dry and abnd. 7,937 ft.

COLORADO COUNTY

Doyle-Concord Oil Co.'s No. 1 Nelson, 3,200 ft. SE of NW cor. of Sec., 2,200 ft. SW at right angles in I.&G.N. Sur.
Drlg. hard sand 6,146 ft.
Quintana Pet. Co.'s No. 1 M. A. Olmstead, 457 ft. N 66 deg. 20 ft. E along S line from SW cor. of 129-ac. tract and 425 ft. NW at right angles in M. Baton Sur.
Drlg. brittle shale 4,271 ft.

FAYETTE COUNTY

Colorado Oil Co.'s No. 1 Anders.
T.D. 2,820 ft.; S.D.
Magnolia Pet. Co.'s No. 1 Max Steinmann, 330 ft. N line and E line of 57.37-ac. tract, or 4,100 ft. S line, 2,000 ft. E line of Ygnacia Almansur Sur., 1¼ miles E of Schulenberg.
Rigging up.

FORT BEND COUNTY

Humble O. & R. Co.'s No. 1 Mrs. Anna Hackstedt, 466 ft. at right angles from SE and SW lines 246.9-acre tract in Robert Hodges Sur.
Rigging up.
W. A. Shafer et al's No. 1 V. B. Bortash, 693 ft. SW of NE line and 1,002 ft. NW of SE line of Sec. 52, H.&T.C. Sur.
T.D. 300 ft.; S.D.
Vico Oil Co.'s No. 1 H. R. Darst, 5,690 ft. N of S line and 685 ft. W of E line of E. Powell Sur.
Rig.
Wilks et al's No. 1 Norris, 300 ft. W and 1,352 ft. S of N cor. of 525-ac. tract (5 miles S of Needville).
Rigged up and S.D.

GALVESTON COUNTY

H. E. Sedberry, trustee's No. 1 Thomas Shaw (200 acres), 150 ft. NW line, 165 ft. NE line, Lot 66, Sec. 7, Hall & Jones, Galveston Island.
Derrick.
Pure Oil Co.'s No. 1 J. W. Shelor (221.2 acres), 2,760 ft. S of Dickinson-San Leon highway and midway E and W lines of lease, B.B.B.&C. Sur.
Rig.

GRIMES COUNTY

Dr. Marshall et al's No. 1-B Todd, 300 ft. from E line and 175 ft. from N line of 150-ac. tract in extreme NW cor. of county (25 ft. N of No. 1).
Laying water line; T.D. 880 ft.
W. D. Roan et al's No. 1 D. C. Kelly, 1,532 ft. from N line and 168 ft. from E line of U. Sanders Sur., near Carlos.
No report.
J. H. Woodward et al's No. 1 O. A. Hamil-

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ton, center of Hamilton 95.5-ac. tract S of Richards in the O. Hill Sur.
Coring 3,290 ft.; no report.

HARDIN COUNTY

Wilcox O. & G. Co.'s No. 1 Sternberger, 1,62› ft. N of S line and 1,311 ft. W of E line of C. Dorsey Sur. No. 1.
T.D. 6,000 ft.; no report.

HARRIS COUNTY

C. C. Foster and others No. 1 H. K. Johnson, 2,000 ft. from S line and center of E and W lines of G.C.&S.F. Sur.
Spud and drlg. water well.

General Crude Oil Co.'s No. 1 Rorick est., 5,606 ft. S of N line of survey and 1,546 ft. W of E line of 1,436-ac. tract in John C. Ogburn Sur.
Drlg. shale 5,850 ft.

Imperator Oil Co.'s No. 1 Brooks est., 7,400 ft. S and W of NE cor. of R. & R. Vince Sur.
T.D. 800 ft.; W.O.C.

Loring Oil Co.'s No. 1 Westmoreland, Lot 3 Blk. 33, Westmoreland Add.
Drlg. hard shale 7,279 ft.

W. U. Paul's No. 1 E. M. House, 2,200 ft. N and 1,000 ft. E of NE cor. of E. Benson Sur. in M. Magruder Sur.
Set 10-in. at 1,000 ft.; drlg. plug.

Southland Oil Co.'s No. 1 Galvey, SE cor Sec. 4, Blk. 1, E.&T.C. Sur.
T.D. 4,761 ft.; S.D.

Texas-New York Dev. Co.'s No. 1 Ralson, 525 ft. from W line and 525 ft. from S line of Lot No. 12 in J. W. Moody Sur
Drlg. lime 3,717 ft.

JACKSON COUNTY

Enclo Gas Co.'s No. 1 J. H. Drummond, 330 ft. out of most easterly NE cor. of Drummond 499-ac. tract.
T.D. 6,012 ft.; P.B. to sand 5,635-75 ft.

Enclo Gas Co.'s No. 1 Seidel & Simmons, 150 ft. from SW line or 300 ft. NE at right angles from No. 1 Toney, in Raymond Musquiz Sur.
T.D. 6,009 ft.; set screen.

Imperator Oil Co.'s No. 1 Dutton, S center of Lot No. 11, Blk. 35, 450 ft. S of R.R and 1,350 ft. W line of townsite, Ray Muskins Sur.
Rigged up and S.D.

Phillips Pet. Co.'s No. 1 State Realty, 1,000 ft. SW and 466 ft. NW of most easterly E cor. of Vanderbilt townsite, in Blk. 95 R. Muskuiz Sur.
Drlg. 3,670 ft.

Turman Oil Co.'s No. 1 T. H. Miller, 150 ft each way out of E 50 acres of Miller 100-ac. tract in Ray Musquiz Sur.
Location.

JEFFERSON COUNTY

Magnolia Pet. Co.'s No. 1 E. Herbert Trust 990 ft. N, 330 ft. E of SW cor. of P. W Bell Sur. No. 2.
Drlg. sand 4,065 ft.

Sun Oil Co.'s No. 1 H. Long, 1,500 ft. N line, 990 ft. E line of lease.
Drlg. sandy shale 8,514 ft.

Turnbull & Irwin's No. 1 Tolivar, 1,900 ft. from N line and 1,400 ft. from W line of NW cor. of Shadric Morris Sur.
Drlg. shale 5,258 ft.

LIBERTY COUNTY

R. M. Bruner et al's No. 1 N. Bell, 150 ft from N line and 150 ft. from W line of Bell's 187-ac. tract, H.&T.B. Sur. No. 4.
Rigging up.

Extension Oil Co.'s No. 1 J. A. Lovett, 200 ft. from E and 600 ft. from S line of lease P. P. Deevers Sur.
Drlg. shale 3,079 ft.

Liberty-Independent Oil Co.'s No. 1 J. M. Neal, 3,550 varas from E line and 500 varas from N line of Samuel Strong Sur.
No report.

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that assure
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Magnolia Pet. Co.'s No. 1 Maco Stewart, 2,500 ft. E and 1,370 ft. S of NW cor. of 350-ac. tract in A. Cherry Sur.
Setting surface csg. 600 ft.

A. L. Maxwell's No. 1 M. D. Hinchliff, 300 ft. from E line and 1,000 ft. from N line of H.&T.C. Sur. No. 150.
Location.

Thomas et al's No. 1-A Eicke, 660 ft. from W line and 2,350 ft. from S line of tract in Green Sur.
T.D. 5,158 ft.; tested S.W. and S.D.

MATAGORDA COUNTY

Continental Oil Co.'s No. 1 Robbins.
Drlg. shale 6,042 ft.

Dr. Griffith's No. 1 fee, 3,000 ft. from N line and 3,000 ft. from W line of Wm. E Bell Sur.
Rigged up and drlg. water well.

Powers Prod. Co.'s No. 1 Northern Irrigation Co., 300 ft. E and 125 ft. N of Sec. of Lot No. 5, Blk. 9, I.&G.N. Sur.
Derrick.

United North & South Dev. Co.'s No. 1 Unit 4, Buckeye farm, J. C. Keller league 214 ft. N line and 202 ft. E line of lease
T.D. 7,880 ft.; cutting and pulling screen.

United North & South Dev. Co.'s No. 1 Unit No. 58, 250 ft. N and 200 ft. W of SE cor of Unit No. 58.
Drlg. 4,220 ft.

MONTGOMERY COUNTY

Brown & Wheeler et al's No. 1 Jones, 440 ft. out of NW cor. of S 175 acres of 350-ac. tract.
Location.

Sayre Oil Co.'s No. 1 Delta Land & Lbr. Co., 330 ft. out of NE cor. of J. Truitt Sur.
Dry and abnd. 5,036 ft.

Shell Pet. Corp.'s No. 1 Crighton, 1,480 ft. W and 290 ft. S of NE cor. of lease in Mary Corner Sur.
Drlg. sticky shale 4,476 ft.

ORANGE COUNTY

Blue Line Oil Co.'s No. 1 Godwin, Richard Bailew Sur., 300 ft. from E line and 150 ft. from NE line of Godwin 20-ac. tract.
T.D. 2,703 ft.; S.D.

Texas Louisiana Oil Co.'s No. 1 Starks, 2,450 ft. N of NW cor. M. Delano Sur. 68, 10,500 ft. E at R/A.
T.D. 5,055 ft.; S.D.

POLK COUNTY

Howard Dailey et al's No. 1 Z. B. Knox, 1,450 ft. W and 1,920 ft. S of NE cor. of F. Chairs Sur., 1½ mile NE of Corrigan.
Spud and S.D.

REFUGIO COUNTY

Heard-Holland Oil Co.'s No. 1 Peck, 366 ft N and W out of NW and SW of Bonnie View Subd.
T.D. 5,351 ft.; 7⅝-in. csg. 5,348 ft.; swabbed down 4,000 ft.; no pressure.

Quintana Oil Co.'s No. 2-A O'Connor, 460 ft. N and 450 ft. W of No. 1.
Drlg. shale 4,695 ft.

Quintana Oil Co.'s No. 1-B O'Connor, 139 ft. E line and 2,525 ft. S line of B.B.B.&C. Sur., Abst. 96.
Drlg. shale 5,002 ft.

SAN AUGUSTINE COUNTY

Fidelity Exploration Co.'s No. 1 Bryan & Flourney, 1,926 ft. from N and 735 ft. from E lines of Sec. 14, S.P.R.R. Sur.
T.D. 2,005 ft.; S.D.; moving in heavy rig to drill to Woodbine.

SAN JACINTO COUNTY

Darby Jones' No. 1 McBee.
Sand and shale 3,017 ft.; S.D.

TYLER COUNTY

Boone-Wallace & Lane's No. 1 Cruse.
Abnd. 3,025 ft.

Woodley Pet. Co.'s No. 1 Acton Young, 330 ft. N and W lines, 250-ac. tract, J. Wheat Sur. 659, 2 miles S of Woodville.
Rigging up.

VICTORIA COUNTY

American Liberty Oil Co.'s No. 1 Gaugler, SE cor. of Gaugler 368-ac. tract and just N of Petrol Corp.'s No. 1 Machaiec.
Location.

American Liberty Oil Co.'s No. 1 Prybil, 330 ft. out of SE cor. of Prybil 122-ac. tr.
T.D. 2,801 ft.; 7-in. csg. 2,784 ft.; comp. 300 bbls. daily.

John F. Camp's No. 1 Zimmer, 330 ft. from SE and NE lines of SW of 58.5-ac. tract of Zimmer 117-ac. lease in R. Manchola Sur.
T.D. 2,209 ft.; comp. 25 bbls. oil and 1,000,000 ft. gas, ¾-in. choke, T.P. 880 lbs., C.P. 950 lbs.

Rupert Cox's No. 1 John Zimmer, 2,185 ft. NE from SW cor. along NW line and 330 ft. SE at right angles, R. Manchola league.
Derrick.

Gulf Prod. Co.'s No. 6 Keeran, begin at intersection of R.R. and SW line of survey, thence NE along R.R. 6,257 ft., thence NW at r/a 2,539 ft. in the M. DeLeon Sur.
Sand 5,595 ft.; 4-min. D.S. test, 250 lbs. dry gas.

Humble O. & R. Co.'s No. 1 McFadden est., 2,000 ft. S. 15 deg. W of Lion O. & R. Co.'s No. 1 McFadden in C. O. Edwards Sur.
Drlg. sand and shale 5,648 ft.

Humble O. & R. Co.'s No. 2 Mitchell, 6,500 ft. NW line, 7,000 ft. from SW line of Mitchell 5,000-ac. tract.
Shale 5,970 ft.

Albert Plummer's No. 1 Zimmer, 330 ft. NE and SE lines of lease in Manchola Sur.
Drlg. shale 210 ft.

Stonelaigh Oil & Gas Co.'s No. 1-A Zimmer.
Derrick.

Texas Co.'s No. 2 McFaddin, 9,150 ft. S and 200 ft. E at right angles out of NW cor. of C. M. B. Hoyt Sur.
T.D. 5,084 ft.; fishing drill pipe.

Texas Co.'s No. 1 J. B. Midgett, N 35 deg. W 1,000 ft. and S 55 deg. W 1,000 ft. from SE cor. of lease in T.&N.O. Sur., Sec. 14.
Rigging up.

WALLER COUNTY

DeArman Bros. Drlg. Co.'s No. 1 Bainbridge, 1,500 ft. S and 1,320 ft. E of NW cor. of Downman (100-ac. tract), 150 ft. SE line, 150 ft. SW line of John McFarland Sur.
Rigging up.

WHARTON COUNTY

Pure Oil Co.'s No. 1 Adams, T. W. Heard Sur., Sec. 26, Abst. 465, 571 ft. NW cor., 467 ft. from SW line out of most westerly NW cor. of Sec.
Bldg. road to location.

Pure Oil Co.'s No. 2 Chas. T. Kountze, 2,310 ft. at R/A from NW line and 990 ft. at R/A from SW line of 240-ac. tract in Morris & Cummings Sur., No. 19.
T.D. 8,155 ft.; cmtd. 9⅝-in. csg. 5,120 ft.; set screen.

Pure Oil Co.'s No. 2 Stewart, Morris & Cummings Sur., Sec. 25, 990 ft. out of SW cor. of 160 acres.
T.D. 8,235 ft.; P.B. 7,491 ft.; preparing to sidetrack.

Pure Oil Co.'s No. 1 J. S. Stidhan, 433 ft. SW and 1,320 ft. SE of N cor. of Stidhan 160-ac. tract in Morris & Cummings Sur. No. 23.
Abnd. 5,218 ft.

Texas Gulf Prod. Co.'s No. 1 Kresta, 440 ft. N and E from SW cor. of tract in Sec. 54, W. B. Ivey Sur.
T.D. 4,401 ft.; reaming.

Tri-State Oil Co.'s No. 1 Fojtek, 300 ft. SE and 114 ft. NE from W cor. of Lot No. 38, S. F. Austin Sur.
Rigging up.

SOUTH LOUISIANA

ACADIA PARISH

Edwards Drlg. Co.'s No. 1 Daigle, NE cor. of SE of Sec. 24-7s-1e.
T.D. 7,494 ft.; reaming.

ALLEN PARISH

Humble O. & R. Co.'s No. 1 Industrial Lumber Co., 1,220 ft. W line and 2,440 ft. S line Sec. 31-3s-5w.
Spudded.

BEAUREGARD PARISH

Federal Pet. Co.'s No. 1-B Lutcher-Moore, 6 miles NW of No. 1 Lutcher-Moore and near Fields.
T.D. 5,700 ft.; fishing.

CALCASIEU PARISH

Fred Oil Co.'s No. 1 Faisst, 566 ft. N, 300 ft. W of SE cor. of NW of SE Sec. 26-8s-10w.
T.D. 2,875 ft.; fishing.

Steinberger Pet. Co.'s No. 1 Drew, 330 ft. out of NW cor. of NE¼ of Sec. 26-10s-11w, 6½ miles SW of Sulphur.
Location.

Union Sulphur Co.'s No. 2 Barbe, 279 ft. S and 350 ft. W of NE cor of SE of Sec. 11-9s-3w.
Drlg. water sand 7,525 ft.

EVANGELINE PARISH

L. Puckett's No. 1 Vidrine, 500 ft. S of old J. E. Ladeau's No. 3 Goodwin and approximately 4,500 ft. E and 1,700 ft. N of SW cor. of Sec. 34-3s-2e.
Location.

IBERIA PARISH

Diamond Corp.'s No. 1 Edmond Victor, 1,900 ft. E and 450 ft. from SW cor. of Sec. 41-12s-5e.
Drlg. sand and gravel 27 ft.

IBERVILLE PARISH

Gross Pet.'s No. 1 Angelloz.
T.D. 2,270 ft.; W.O.C.

JEFFERSON DAVIS PARISH

Humble O. & R. Co.'s No. 3 Devilbiss, 1,320 ft. W, 466 ft. S of NE cor. Sec. 14-9s-4w
Drlg. shale 8,203 ft.

Humble O. & R. Co.'s No. 1-B DeVilbiss.
Rigging up.

Humble O. & R. Co.'s No. 1 Martin Kratzer, 400 ft. out of SE cor. 120-ac. tract, Sec. 14-9s-4w.
Drlg. lime 7,276 ft.

Shell Pet. Corp.'s No. 1 Jernigan, 330 ft. E. 660 ft. S. NW cor. Sec. 12-9s-4w.
Drlg. sandy shale 8,168 ft.

Tide Water Oil Co.'s No. 1 Mrs. A. Bourgeois, 250 ft. E and 205 ft. S of C of Sec. 23-9s-5w.
T.D. 6,107 ft.; P.B. 5,050 ft. to sidetrack to sand 5,292-5,325 ft.; 5,260 ft., gas sand; mixing mud.

LAFOURCHE PARISH

Barnsdall Oil Co.'s No. 3 Harang Plantation.
Drlg. shale 5,450 ft.

R. L. Gay, trustee's No. 1 Godchaux, 3,920 ft. N and 1,746 ft. E in common cor. of Lots 24 and 26, Twp. 15s-19e.
T.D. 6,360 ft.; 10-in. csg. collapsed.

Southern Sulphur Corp.'s No. 1 D. L. Lagraize, 800 ft. E of NW cor. of Lot 7, thence 250 ft. S of Sec. 26-21s-22e.
Spudded and S.D.

PLAQUEMINES PARISH

Venice Corp.'s No. 1 Burras.
Hard sand and lime 1,533 ft.

RAPIDES PARISH

C. D. Lee's No. 1 Barrett, 330 ft. NW of SE line and 880 ft. NE of SW line of Sec. 40-5n-1w.
Rigging up.

ST. BERNARD PARISH

Danciger's No. 1 Battles, 836 ft. N, 2,193 ft. W of SE cor. Sec. 135-14s-14e.
No report.

ST. LANDRY PARISH

Bailey Gaunce's No. 1 Lewis, 300 ft. N and E of SW cor. of NW of NE of Sec. 29-5s-6e (workover).
T.D. 5,017 ft.; S.D.

ST. MARTIN PARISH

Texas Co.'s No. 6 St. Martin Land Co., 600 ft. S and 500 ft. W of NE cor. SE Sec. 17-8s-7.
T.D. 8,200 ft.; running 9⅝-in. csg.

ST. MARY PARISH

Black et al and Edwards Drlg. Co.'s No. 1 Chetimanchа, Sec. 34-13s-9e, 219-ac. tract approximately 500 ft. at right angles SE and SW lines of tract.
T.D. 6,501 ft.; S.D.

VERMILLION PARISH

Moore Bros.' No. 1 Brussard, 350 ft. S of N line, 250 ft. E of W line, NE cor. Sec. 32-11s-3e.
T.D. 4,046 ft.; fishing.

TECHNICAL QUESTIONS ANSWERED

By Charles K. Francis, Ph. D., Technical Editor

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with

marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible.

Inquiries must be signed but only the given initials will be printed. The source of the question is considered to be confidential.

Questions requiring a discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered.

When the matter is of general interest the reply will be published within a reasonable time.

Manufactured Gas as Source of Benzol by Absorption

Since benzol is being used in increasing volume and only limited quantities are available, I understand that recently more attention has been given to the recovery at artificial gas plants and wish to know if you have any figures on the process and yields obtained?—E. W. G.

The manufacture of benzene, or the commercial benzol used as an antiknock material, is in the main confined to the coal tar industry, especially the coking retorts, but the gradually increasing demand for the product has caused attention to be directed to the low B.t.u. gas, known to contain small quantities of the compound. The extraction is accomplished by passing the gas through an oil absorption unit. A short article, describing a British plant, was published in Ind. Eng. Chem., News Edn., 12, 190, 1934, from which the following description is abstracted:

The oil washing plant is located at the outlet of the coal gas purifiers, and is a rotary-brush washer scrubber installed as a naphthalene washer. It is now efficiently working as both naphthalene and crude benzene washer.

The benzene extraction plant produces 2.03 gallons of benzene per ton of coal, and, more recently, 2.50 gallons, with an average rate of oil circulation of about 140 gallons per hour and a maximum daily carbonization of 100 tons of coal.

A rotary circulating pump delivers benzolized oil from a well to an overhead feed funnel. The oil flows by gravity to a tubular oil-to-oil exchange heater, surplus oil returning to the well and being used to wash the ascending stream of foul gases from the various plant vents. A temperature of approximately 65° C. is reached in the heat exchanger, and final heating to 135° C. is carried out in a steam heater containing a steam coil. From the top of the steam heater the oil is passed to the top of a stripping still of the tower type. Live steam is applied at the bottom of the still at 25 pounds per square inch, the debenzolized oil leaving the still at a temperature of 115° C. and passing through the heat exchanger before entering a water-tube cooler at 55° C. In the cooler, water flows countercurrent to the oil, which is cooled to a temperature of approximately —15° C. above the gas temperature at the oil washer inlet. From the outlet of the cooler the oil returns direct to the gas outlet end of the oil washer.

The vapors leaving the top of the stripping still are passed to a fractionating column which is surmounted by a water-cooled reflux condenser, thermostatically controlled, the benzene vapors and steam leaving at 84° C. A water-cooled coil condenser liquefies the vapors, which then flow to an automatic separator by way of a sight glass. A similar separator at the bottom of the fractionating column deals with the naphthalene fraction. The wash oil used is gas oil of 0.860 specific gravity, the distillation test showing first drop at 190° C. and 90 per cent over at 340°C.

The rate of oil circulation is adjusted according to the volume of gas passing and the degree of stripping desired. New gas oil is added continuously at the rate of about 0.6 gallon per gallon of crude benzene made, the surplus of benzolized oil being regularly pumped to the carbureted water-gas plant oil storage tank which receives the naphthalene fraction also. The crude benzene gravitates to a well from which it is pumped into road tanks for removal to the refiners.

The total cost of production (naphthalene and benzene) is 1.7d (38 cents par) per Imperial gallon of crude benzene.

Factors Involved in Designing Petroleum Pipe Stills

What are the essential factors to be considered when designing a pipe still for the calculation of heat transfer and consequently its capacity?—H. A. R.

The pipe still now used in petroleum refineries, similar to the water tube boiler for the production of steam, was first used for distillation in the coal tar industry and has been brought to a high degree of efficiency within the past 10 years for the distillation of crude oil and petroleum products.

It is not possible to select a set of conditions which will be applicable to all crude oils, distillates and resdues that are to be distilled in a pipe still. It is not possible for the designer of a pipe still to have available all of the numerous variables that have to do with the satisfactory operation of a still, but certain fundamental data may be obtained and adequate allowances are made on the basis of experience for other factors.

A very good presentation of the general problem has been made by Charles E. McCulloch, in The Oil and Gas Journal, May 10, 1934, page 92, under the title, Design of Radiant Absorption Section Pipe Still Coils Fired With Oil or Gas Fuel With Air. Several charts are used to assist in the estimates.

Perfect combustion of a fuel is not possible in the furnace, and just how high the fireman may get his efficiency will depend on a number of things. A chart is used to show the relationship between the percentages of carbon dioxide in the flue gases, temperature of the gases and percentage of total heat lost through escape from the stack for typical oils and gas fuels. The assumed heating value of fuel oil is selected at 19,000 B.t.u. or more, with a composition of 88 per cent by weight of carbon and 12 per cent of hydrogen. Another chart covers the heating range of gas from 600 B.t.u. per cubic feet to 1,500 B.t.u., but the chart is based upon a heating value of 940 B.t.u.

It is the general practice to allow 5 per cent radiation and convection loss from the brick setting. The overall efficiency being calculated as the difference between 100 and the percentage heat loss shown on either chart increased by 5 per cent. The rate of heat transfer depends upon rate of oil circulation and the maximum temperature to which the tubes may be heated without damage. Related to these are: (a) Allowable oil velocities as fixed by allowable pressure drop; (b) tendency of the oil to overheat with deposition of coke on the inside of the tubes; and (c) tendency of oil, especially lubricating stocks, to be darked when heated to high temperatures. Conditions and types of oil heaters introduce other variables, which may mean a great range in temperature. The choice between radiant surface arrangement in single row or double row, the use of shields for a part of the tubes, the soaking period and pressure conditions are additional factors.

Mr. McCulloch mentions these references:

Radiant Heat Tranmission Between Surfaces Separated by Nonabsorbing Media, H. C. Hottel, Trans. A.S.M.E., 53, 265, 1931.

Heat Transmission in Radiant Sections of Tube Stills, D. W. Wilson, W. E. Lobo, H. C. Hottel, Ind. Eng. Chem, 24, 486, 1932.

Heat Transmission in Convection Sections of Pipe Stills, C. C. Monrad, Ind. Eng. Chem., 24, 505, 932.

Quality of Bunker C Fuel Oil at Gulf Ports

Can you furnish us with the specific gravity, the heating value, maximum and minimum on both, of Bunker C Fuel Oil such as is used by the U. S. Navy and loaded at Gulf Ports?—E. A. B.

The Federal specification for Bunker C fuel oil is flash, min., 150° F.; Furol viscosity at 122° F., 300 seconds; water and sediment, 2 per cent, of which sediment shall not be more than 0.25 per cent. Oils of different properties are supplied to comply with this specification. Frequently the most difficult item to meet is water and sediment, because the other properties are by nature, being a residue product, satisfactory. The water and sediment are maximum, the flash-point, a safety provision, is a minimum requirement, and the Furol viscosity is a maximum, being equivalent to approximately 3,000 Saybolt Universal at 100° F. The refiner will usually have stocks available to permit blending to meet the purchaser's needs; so while meeting the basic stipulations for Bunker C fuel there may be an appreciable range in gravity, heating value, pourpoint, and sulphur.

Several analysis of the fuel oil shipped from Gulf ports show the following range in properties.

Quality Bunker C fuel oil, Gulf ports: Gravity, A.P.I., 12-16; specific gravity, 0.9861 to 0.9593; heating value, 18,730 B.t.u. to 18,890 B.t.u. per pound. The further details that may be included are indicated in the analysis following of one sample:

HEAVY FUEL OIL	
Gravity, A.P.I.	13.8
Gravity, specific	0.9738
B.t.u. per pound	18,802
Flash, deg. F.	255
Sulphur, per cent	0.75
Furol viscosity at 122° F.	279
Pourpoint, deg. F.	0

When Reducing Petroleum to Coke Ammonia Forms

We notice the fumes of ammonia about the stills when we are making heavy fuel oil and when reducing to coke. Is this common to all oils or is it something special?—E. T. S.

Nitrogen, which combines with hydrogen to form ammonia, is found in many crude oils but the quantity is usually below 3 per cent and in many oils less than 1 per cent has been found. Just what form of nitrogen exists in petroleum is not always clear, but it is well known that ammonia is evolved during the last stages of distillation. It is also known that hydrogen is given off in excess during the cracking stage, reducing to coke would be above the cracking temperature, so the conditions are favorable for the formation of ammonia.

Some experiments that were made under my supervision some years ago suggested the favorable condition with respect to Mid-Continent oils of the higher gravity, the mixture containing a large portion of Cushing crude oil. It was shown that the quantity of ammonia produced was greater when the heating took place at a slow rate. The ammonia began to form when the temperature of the oil was 700° F. (still temperature), at this stage the oil was thick, but smooth with no sign of carbon or coke. However, when the coke begins to form the ammonia comes off faster and continues to be produced freely during the entire coking period.

The following quotations from Gurwitsch-Moore, Petroleum Technology, pages 170 and 171, may be of interest.

The nitrogen content of most petroleum oils, like the sulphur content, is very small. The German petroleum oils (Kraemer and Boettcher) seem to be generally free from nitrogen. The Caucasian oils, according to Beilby, contain 0.05 per cent of nitrogen, the Rumanian oils 0.09 to 0.12 per cent and the Pennsylvanian only 0.008 per cent. Among those richer in nitrogen are the oils of Japan, Ohio, and particularly Californian oil, in which Mabery found up to 2.35 per cent of nitrogen.

It is interesting to note that the oils free from nitrogen have often a particularly high sulphur content. Peckham calls attention to the fact that the greatest nitrogen content is to be found in the deep-lying petroleum oils.

As regards, the distribution of nitrogen compounds in the various fractions of a crude oil the same rule as that for the sulphur compounds genertily prevails. The content of nitrogen is greatest in the higher fractions and in the residues, Mabery found in the coke from Ohio petroleum 0.31 per cent of nitrogen, and in the coke from Canadian petroleum 0.38 per cent of nitrogen.

NEWS FOR PETROLEUM REFINERS

Van Gundy and Scanlin Patent Suit Dismissed

NEW YORK, Aug. 18.—In an opinion handed down last week by District Judge Bondy in U. S. District Court, Southern District of New York, in the suit brought by the Texas Co. against Sinclair Refining Co. on the Van Gundy & Scanlin patent No. 1,599,854, a decree was ordered "adjudging the patent invalid and dismissing the complaint."

The patent involved in this case relates to a grease suitable for the lubrication of high-speed bearings carrying heavy loads and subjected to high temperatures such as locomotive driving journals. It was conceded in the trial of the case that such grease should be deglycerinated as well as dehydrated. The court found that:

"The claims in general cover substantially anhydrous lubricating grease comprising a viscous hydrocarbon oil or cylinder stock and soda soap in about equal proportions and in large amounts and having a melting point of about 450° F., or of the order of over 400° F. The patent does not state what is meant by equal proportions or large amounts or in what manner or by what method the melting point is to be determined."

The first hearing in the case was held in January, 1931, and the last brief was filed in December, 1932. The transcript of the minutes cover over 4,500 pages and the briefs over 600 printed pages. The case has attracted considerable attention among refiners and compounders of greases.

In its decision the court found in part: "In my opinion the patentees failed to comply with the patent law and failed to describe the invention and the manner and process of making and compounding it in such full, clear and exact terms as to enable any person skilled in the art to which it appertains to make, compound and use the same. Following the directions of the patent does not lead with certainty to the production of a grease free from glycerine or suitable for the purpose stated in the patent.

"The patent by which they claim protection for their invention does not contain a full and a fair disclosure of their invention enabling those skilled in the art to reproduce the patented product without experimentation. An independent invention would be required by the skilled grease maker to produce the product. There should therefore be a decree adjudging the patent invalid and dismissing the complaint."

HARTOL PLANS NEW TERMINAL

NEW YORK, Aug. 18.—The Hartol Oil Products Corp. has completed plans for the erection of an ocean oil terminal at Revere, Mass., and it is expected that it will be completed and ready for operation by October 10. The terminal will include storage tanks with a capacity of 235,000 bbls. It will be built and operated by the Hartol Terminal Corp., a subsidiary of the Hartol Products company, and will cost approximately $500,000. Henry D. Vanderwyk will be in charge of the terminal. The Hartol company is a large marketer of petroleum products along the Atlantic Seaboard and the new terminal will enlarge its service to independent jobbing interests in New England.

OPERATE NEW REFINERY

The Corpus Christi Refining Co. began operation August 11, employing 20 men on a payroll of $3,000. The plant will operate at full capacity as soon as test runs are completed. The plant will process from 1,000 to 1,500 bbls. of crude from near-by Texas fields. G. L. Rowsey heads the new company.

Restricted Imports, Tax on Foreign Oil, and Curtailment Affect Fuel Oil Prices

The contention that prevailing prices for fuel and heating oils are fair was laid before the oil administration in a brief submitted for some of the larger distributors of these products and made public today by Secretary of the Interior Harold L. Ickes, the oil administrator. Fuel and heating oil prices are being investigated by the Petroleum Administrative Board, under instructions from Administrator Ickes, because of complaints from consumers and some distributors that present price levels are too high. The board is to gather all facts and report to Administrator Ickes, with a recommendation for such action as the facts warrant.

The brief contended that in considering the price of fuel and heating oils, the relationship between petroleum prices and the prices of other commodities must be weighed. It said that the general wholesale commodity price level, with 100 in 1926 as the index, had declined to 95.3 in 1929; 86.4 in 1934; 73 in 1931; 64.8 in 1932 and 59.8 in February, 1933, with a subsequent rise to 73.7 in 1934. The prices of petroleum products, the brief set forth, declined from 100 in 1926 to 71.3 in 1929; 61.5 in 1930; 39.5 in 1931, rose to 45.4 in 1932 and dropped to 31.2 in 1933, with a rise to 50.7 in May, 1934.

"The relative increase for petroleum products has been greater than for wholesale commodities generally," the brief continued, "but even this increase brought the petroleum products price index to a level substantially below the level of wholesale commodity prices."

Referring specifically to bunker oil, the heavy grade of fuel oil, the brief said a recent increase in prices was necessary for the following reasons:

"Prior to June 21, 1932, when there were no restrictions on the importation of crude oil, American buyers along the Atlantic Coast became accustomed to relatively low fuel oil prices.

"Governmental restrictions, effectively enforced, coupled with curtailment of refinery runs soon resulted in the demand for this particular grade of fuel oil far exceeding the supply on the East Coast.

"'Due to this acute shortage last year, it was necessary for large fuel oil suppliers to go to the West Coast in order to obtain sufficient oil to fulfill large industrial and marine contracts already on their books. Governmental restrictions prevented any increase in the importation of foreign oil, so that California oil was the only alternative.

"As the demand to replace the Eastern refinery fuel oil shortage became more i n s i s t e n t, the California cargo price strengthened, necessitating a corresponding increase in the New York posted price.

"Another and equally important contributing factor in the added cost of bunker C, is the fact that Venezuela is on the gold standard putting this crude at a premium over domestic crude.

"It is apparent that restricted imports, the 21 cents per barrel duty on foreign oil and governmentally controlled domestic crude production and refinery runs are factors responsible for present Grade C bunker fuel oil prices.

"In conclusion a comparison of prices of all grades of fuel oil for the season 1933-1934 with present prices would be useless and decidedly unfair, unless related to the average price of crude in the United States during 1933, which was approximately 68 cents per barrel. A very large amount of fuel oil consumed during the 1933-1934 season was manufactured from low priced crude, while the fuel oil required for the coming heating season is now being manufactured from crude costing approximately $1 per barrel.

"In addition, it is necessary that distributors of fuel oil recover increased costs due to the reduction in hours of plant and distributing force to comply with NRA labor provisions."

Going Back 15 Years or More

One of the earliest Dubbs cracking installations

Western Montana Retail Conditions Are Strained

Crude oil marketing conditions in northern Montana are reported to have reached a crisis as a result of competition between companies building up markets for refined products in several Canadian provinces and important developments may be expected within the next few weeks. In the absence of confirmation due to officials of the companies involved being out of the city, the reports are given as they come to hand.

Early in the present year the British-American Oil Co., Ltd. purchased the Northwest Stellarine Co.'s refinery at Coutts, Alberta, and its marketing outlets in Alberta and Saskatchewan provinces. Plans were at once put under way for enlarging these facilities. The same interests also own a topping plant at Moose Jaw, Saskatchewan, which it proceeded to enlarge. Imperial Oil, Ltd., also operates the Maple Leaf refinery at Coutts through a subsidiary, and the International Refining Co., subsidiary of the Texas Co., operates a refinery at Sunburst, Mont. These companies purchased their crude supplies from northern Montana operators, principally in the Kevin-Sunburst Field.

Several months ago the Canadian subsidiary of the Texas Co. began expanding its retail and wholesale market outlets in the Canadian provinces. The products for these outlets are supplied by the International refinery, while the Coutts and Moose Jaw plants furnished the products for the other companies.

The British-American interests have just completed and put into operation an oil line from Cut Bank to Coutts. This was built by a subsidiary, the Toronto Pipe Line Co. These interests became active in the Cut Bank Field by making contracts for production, financing some drilling operations, and making an active effort to obtain crude. The International Refining Co. posted a price of $1.45 a barrel for Cut Bank crude and the pipe line company put into effect a tariff of 22½ cents a barrel on crude from Cut Bank to Sunburst. The Illinois Pipe Line Co. has a rate of 5 cents a barrel from Sunburst to Coutts, a total of 27½ cents from Cut Bank to the Canadian terminal. The Toronto Pipe Line, upon completion of construction, established a tariff of 22½ cents from Cut Bank to Coutts, or 5 cents under the joint rate of the other system. At about the same time new contracts with producers are said to have been offered under which Cut Bank crude will be purchased at prices posted by the British-American company. Such action will establish two posted prices for the field, which with pipe line differential, opens the way for a competitive market between the various companies.

ACT TO HALT TAX EVASION

Alarmed by the growth of tax evasion, many states are making closer checks on claims for tax refunds. From 10 to 30 per cent of all gasoline in 13 states last year was sold free of tax. Kansas, North Dakota, Arkansas and New Jersey felt the collection losses most keenly. It is believed that much of the evasion is due to diversion of gasoline bought for farm use. Repeal of refund rights and control of interstate shipments has been resorted to in remedying the evil. Better enforcement of tax collection will be of benefit to the average motorist.

USS

PLYKROME

can be welded

. . . or hot formed

without subsequent heat treatment

For those articles in which heat treatment is difficult or impossible after fabrication, USS Plykrome is ideally suited. Its corrosion-proof surface is of Stabilized USS 18-8 Stainless Steel. This special stainless resists intergranular attack even under the most severely corrosive conditions.

As a consequence Plykrome can be welded successfully or subjected to high temperatures during fabrication or service without loss of its corrosion-resistant qualities. Furthermore, the stabilizing treatment given to Plykrome to insure its resistance to corrosion is such that the steel backing is put into the best possible condition for forming. This unique quality makes Plykrome a practical metal for many applications which cannot employ unstabilized stainless steel.

Additional information on the use of Plykrome in specified installations may be had upon request.

A striking indication of the difference between ordinary 18-8 stainless and the stabilized 18-8 used as the surface veneer on USS Plykrome. Here a piece of low carbon USS 18-8 (on the left) has been welded to USS Stabilized 18-8 (on the right) and subsequently put in an acid bath. Note the manner in which the unstabilized steel has been corroded adjacent to the weld. The stabilized stainless, however, is entirely free from attack.

USS

Illinois Steel Company

208 S. LA SALLE STREET, CHICAGO, ILL.

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

U S S CHROMIUM-NICKEL ALLOY STEELS ARE PRODUCED UNDER LICENSES OF THE CHEMICAL FOUNDATION, INC., NEW YORK, AND FRIED. KRUPP A. G. OF GERMANY

FIELD PROBLEMS FROM READERS

Edited by Thomas F. Smiley

This department is conducted in order that men connected with the drilling, producing and transporting branches of the petroleum industry may obtain aid in solving problems that confront them in their work. Readers are invited to send questions freely. These questions will be placed in the hands of persons capable of answering them authoritatively, and the answers, based on the best available information, will be published.

Each question should give as much detail as possible, especially if it involves depths of sands, types of sands and operations on adjoining or nearby properties. The source of questions will be considered confidential, and only the initials of the sender will be published. Questions involving patented processes, intricate formulas or estimates of cost cannot be answered. If an immediate answer is important, one will be given by mail when the writer requests it.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or improved old ones.

Acid Treatment Might Benefit in Case of This Michigan Well

We have a well here on which we believe some sort of automatic flowing device can be used very advantageously. This well is producing from the Dundee lime, topped at 2,693 feet (surface elevation 1,017 feet). First oil was encountered at 2,715 feet, the formation being extremely hard. This hard formation continued to 2,780 feet, carrying a little oil and gas all the way and actually making on the pump 7 bbls. per day at this depth, with a shut-in pressure of 100 pounds at the casinghead. The well was deepened to 2,830 feet, the present total depth, and a soft, extremely porous steak, carrying oil, was drilled at 2,792 to 2,800 feet, and the hole filled up 1,800 feet with oil. It swabbed 85 bbls. in 24 hours. On the beam now it pumps 25 to 30 bbls. daily, pumping 8 hours, and pumped off, builds up a casinghead pressure of 100 pounds in 3 hours. The well is equipped with standard 2-inch tubing, ¾-inch rods and ordinary standing and traveling valves. The gravity of the oil is 36 degrees. Do you believe we are getting all this well is capable of making? I recall an article in The Oil and Gas Journal entitled "Automatic Flowing of Small Wells," in which was described a method perfected by the Tidal Oil Co. engineers for flowing wells by introducing air or gas under pressure from a central compressor station, the flow string being ¾-inch pipe. Please advise if this method proved satisfactory.—L.M.C.

Attempting to diagnose and recommend remedy for a condition such as you outline from a point outside of the field is rather difficult. You have given a good outline of the conditions existing at the well, but further information would be helpful.

It would seem that after drilling through the upper pay enough gas entered the well to build up a pressure of 100 pounds in the casinghead, but not enough to flow the well. This supposition seems to be confirmed by the fact that after pumping the well off after oil has risen to 1,800 feet above the bottom of the hole the casinghead pressure builds up to 100 pounds within three hours.

A fluid column of 36 gravity oil 1,800 feet high would exert a pressure of approximately 660 pounds per square inch at the bottom of the hole. The formation pressure is not enough to lift the oil all the way to the surface or you would have a flowing well.

While it is probable that you might obtain some mechanical device that would aid in producing this oil it seems unlikely that any mechanical equipment could supply sufficient energy to flow the oil the remaining 1,000 feet or more above the normal level to which the oil rises when the well is shut in.

The first thought would be that this well might be benefited by a treatment with hydrochloric acid and it is suggested that you submit your problem to experts in this field of oil operations.

Out of 900 producing wells in Michigan, 700 are producing from limestone formations considered favorable for the stimulation of production by the use of acid according to a paper by K. A. Covell, presented before the A.P.I. meeting in Pittsburgh, Pa., recently. It is believed the results he outlines justify your giving acid treatment serious consideration, because it is evident that the well's capacity is only about 30 bbls. per day, hardly enough to justify any elaborate flowing devices.

It is not intended to imply that flow devices are not successful. They have done much to aid in producing oil, but from the experiences reported from acid treatment in the Dundee limestone in Michigan it would seem wise to give that method first consideration.

Fashioning of Hollow Steel Balls by "Spinning" Requires Skill

The other day I saw a hollow steel ball for the standing valve in a working barrel and the pumper told me it had been made by "spinning." Can you advise me the process used in making this piece of equipment by the "spinning" method?—A. W. I.

The spinning of metals is not a new art and brass has been formed by this method into many objects that could not be made in any other way. Silver and silver alloys also lend themselves to the spinning process and are used to some extent in making balls.

The spinning of steel is somewhat more difficult, but the same general methods are followed in forming these hollow balls as is used in spinning brass or silver.

To form the ball a section of steel tube is selected that has the required wall thickness and is of such length that when the metal is formed into a sphere there will be neither surplus nor shortage.

The short tube is held in a lathe chuck in the usual manner and rotated while a forming tool is pressed against the outer edge of one end of the tube to turn the metal inward. Pressure and heat of friction will gradually form this tube into one-half of a sphere at the first operation. The metal is actually caused to flow by the force applied and by careful manipulation a perfectly round and balanced ball can be made. The second step is to reverse the tube in the lathe chuck to shape the other half of the sphere the same as the first half was finished.

When completed the ball is polished and it may be tempered to give it hardness, but it must be balanced and it is a very nice mechanical feat to form a ball out of steel by this method. With brass and silver, the metals being softer, the spinning is easier, for the flowage is caused under less pressure than is required to shape the steel tube into the hollow steel ball.

Estimating Pressure Exerted at Bottom of a Fluid Column

Can you give me some simple and fairly accurate method of estimating pressure exerted by a fluid column at the bottom of a well, tank or other receptacle? How can the weight of columns of various fluids be compared and what factors are necessary to know in order to make these calculations?—W. J. C.

About the simplest way to estimate pressure exerted at the bottom of a fluid column is to multiply the height of the column expressed in feet by .434 pound, the weight of a column of water 1 foot high and 1 square inch at the base. In other words any column of water will exert a pressure of about .434 pound per square inch at its base if it is pure water at 62° F.

For instance, if a well is full of water and is 1,000 feet deep the pressure exerted at the bottom of the hole would be about .434 pound per square inch of surface. If the water is salty it will weigh more and brines will vary in specific gravity from 1.1 to 1.25.

To determine the bottom hole pressure due to this increased weight of salt in the fluid it is only necessary to multiply the weight of the column of pure water by the specific gravity of the salt water. For instance the salt brine has a specific gravity of 1.15 and the pressure per square inch for the 1,000-foot column would then be 1,000 × .434 × 1.15 or 499.1 pounds per square inch.

Oil weighs less than pure water in most instances and specific gravities range from 0.966 for 15 degrees A.P.I. heavy oil to 0.720 for 65 A.P.I. gravity light oil. Oil of 35 A.P.I. gravity has a specific gravity of 0.85 and to find the weight of a column of this fluid multiply the height of the column by .434 by the specific gravity of the oil. In this instance, with 0.85 as the specific gravity, the pressure per square inch at the base of a 1,000-foot column would be about 368.90 pounds.

Rotary muds vary in weight from 8 pounds per gallon to 16 pounds per gallon and in specific gravity from .96 to 1.92. The average mud weight is from 10 to 11 pounds with specific gravities of 1.20 for 10-pound mud; 1.26 for 10.5-pound and 1.32 for 11-pound mud. The weight of the column of clear water should be multiplied by the specific gravity of the mud used. For instance with 10-pound mud the pressure per square inch exerted at the bottom of a 1,000-foot column would be 1,000 × .434 × 1.20 or 520 pounds.

If the column of fluid or rotary mud is gas-cut it is lightened and does not exert as much pressure on the bottom of the hole as would be exerted by fluid free of gas. To estimate the difference in pressure at the bottom of the hole due to lightening of the column by adding gas is somewhat involved and it is probably simpler to assume that the entire column of mud has the same weight as that portion being discharged at the surface and take the specific gravity of the returns as representing the pressure of the column on the bottom of the hole.

For instance, 11-pound mud is being used and is returning from the hole weighing only 9 pounds per gallon. Eleven-pound mud has a specific gravity of 1.32 and the column going in would weigh .32 more than clear water, while the 9-pound mud returning has only 1.08 specific gravity so the column would weigh only .08 more than water.

Again assuming the 1,000-foot hole, the pressure exerted by the 11-pound mud would be 1,000 × .434 × 1.32 or 571 pounds per square inch. For the return column weighing 9 pounds at discharge the column pressure equals 1,000 × .434 × 1.08 or 468 pounds.

Tables of specific gravities of fluids, muds and gas are easily obtained and by starting with the pressure exerted by clear water it is not difficult to determine the column pressure of other fluids. These estimates are expressed in terms of "pounds pressure per square inch" and this usually is the value desired, but if it is necessary to estimate the total weight of the column in a hole the size and length of each section of a given diameter must be known so that the volume of the whole column can be computed. Then the weight in pounds per cubic foot can be ascertained and water at 62° F. weighs 62.355 pounds. Knowing the volume of the fluid in the hole in cubic feet, multiply this volume by the weight of water (62.355 pounds per cubic foot) and that result by the specific gravity of the fluid in question. The result will be the total weight of the fluid in the hole, or in any portion of it on which the volume has been calculated.

Why Was It Called That?

MOUSETRAP

While the core-catcher in a core-barrel ordinarily consists of a ring fitted with fingers of spring steel to keep the core from dropping out of the barrel while it is being raised to the surface, a different sort of device is used by some drillers in especially soft and loose formations. The ring is equipped with hinged leaves instead of steel fingers. When these leaves close little space is left between them for the loose formation sample to sift through. That is to say, the core is trapped, and this suggested the name "mousetrap" commonly used.

NATURAL GAS DEVELOPMENTS

Big Coal Selling Campaign Aimed at Gas and Oil Use

CINCINNATI, Ohio, Aug. 20.—A gigantic sales campaign on the part of Appalachian Coals, Inc., which markets 73 per cent of the southern bituminous coal and one-sixth of the commercial coal supply was opened at the second annual meeting of the coal operators and sales agents of the corporation.

The market research department will have a crew permanently in the field to study every industrial consumer, to make a record of his equipment and needs, the kinds of coal he uses and why, and to report in detail under what conditions these consumers could be made to use Appalachian coal.

T. A. Marsh, consulting engineer, Seattle, said, "that due to the hand-firing of coal, tremendous tonnage had been lost to oil and gas—over 1,000,000 household oil burners and 225,000 gas burners have been installed.

"The development of automatic coal burners has enabled the coal industry to reclaim much tonnage from oil and gas due to the greater economy of coal when burned on mechanical coal burners." The coal burner or stoker industry had its largest year with 15,000 units involved. This year is going at the rate of 25,000 units, and by thorough co-operation between the coal industry and the stoker industry Mr. Marsh predicts that most of the lost tonnage will be soon reclaimed.

Formulas for the Design of Parallel Gas Lines

Several formulas, to facilitate the design of natural gas pipe line systems consisting of parallel lines, have been derived by engineers of the U. S. Bureau of Mines and reported in a recent publication of the bureau. Curves and tables have been prepared from these formulas to simplify materially the calculations and the determination of the sizes of pipe to be used in paralleling various diameter lines to give the most economical design.

As a result of the large expansion of the natural gas industry almost all the markets within economic distance from the developed gas fields have at least one pipe line supplying them with natural gas. Small increases in consumers' demand for natural gas can be met usually by increasing operating pressures; but any marked increase in demand necessitates paralleling sections of the existing systems. It is believed that to a large extent future expansion in the natural gas industry will consist of paralleling the present systems. It has been common practice in the past when calculating problems related to parallel lines to use the method of trial and error. The formulas derived by bureau engineers from Weymouth's formula for the flow of natural gas through pipe lines permit solving directly problems dealing with parallel gas lines. In general there are three main formulas and the points they cover are as follows:

1. To determine the portion of the entire length of line of given diameter it is necessary to parallel with the same or different diameter line to increase the delivery a desired amount.

2. To determine the flow through a system for any percentage of line paralleled with the same diameter line or any other diameter.

3. To determine the diameter of the parallel line necessary to increase the flow a given amount for a given portion of line paralleled.

Examples are included to show the details of application of the several formulas to problems of design of parallel lines.

A series of curves and tables are included which reduce materially the number of calculations and illustrate clearly the size of pipe to be used in paralleling various diameter lines to give the most economical design. Several examples illustrate some of the economics pertaining to the design of parallel lines. From the comparative cost data for the different diameter lines obtained in the literature, the general trend is a decrease in cost as smaller diameter lines (necessitating paralleling more of the entire length of the original line for a given increase in gas delivery) are used for paralleling. However, for any particular gas transmission system other factors may enter in a determination of the most economical design of parallel lines. For instance, only a limited length of the pipe line right of way may be easily accessible and satisfactory for laying pipe lines, whereas the remainder of the pipe line may traverse swamps, mountains or areas of corrosive soil where the cost of construction and maintenance is much higher and paralleling this section may not be economical.

Copies of Report of Investigation 3241, "Formulas for Designing Natural Gas Pipe Line Systems Consisting of Parallel Lines," by T. W. Johnson and W. B. Berwald, may be obtained free of charge from the U. S. Bureau of Mines, Department of the Interior, Washington, D. C.

TRI-UTILITIES CORP.

Although the Tri-Utilities Corp. showed assets of $47,373,818 on its books, August 26, 1931, just prior to its being placed in receivership, its assets were finally sold for $4,806,181, Lewis G. Prichard, Federal Trade Commission examiner testified before the commission.

Mr. Prichard said that minor adjustments of accounts of Tri-Utilities, organized in 1929 by G. L. Ohrstrom & Co., had preceded the final sale. He also testified that company officials had spent more than $350,000 in an effort to maintain market prices for the common stock and debentures.

LINCOLN, ILL., TO NATURAL GAS

A change to natural gas is being made at Lincoln, Ill. The Panhandle Illinois Pipe Line Co. is to construct a main from its Peoria line at a cost of $16,136 which the company is authorized by the Illinois Commerce Commission to borrow from the distributing company, the Central Illinois Electric & Gas Co.

An anticipated reduction in rates of 25 per cent for domestic users and 35 per cent for industrial or commercial purposes and for house heating has been announced.

OKLAHOMA CITY FRANCHISE

In Oklahoma City a campaign is being initiated to get the people to vote $4,000,000 in bonds at a special election October 2 for a municipal gas distribution system. Officials of the Oklahoma Natural Gas Co., holders of the present franchise which expires in October, have announced they will take no part in the battle and will delay their franchise renewal request until after settlement of the municipal plant question.

UNION GAS PICNIC

CHATHAM, Ontario, Aug. 18.—About 125 employes of the shop staff of the Union Gas Co. at Chatham took part in the annual picnic held at Rondeau Provincial Park last week.

Lone Star Co. Protests Fort Worth Ordinance

FORT WORTH, Tex., Aug. 20.—Recently the city council passed an ordinance "regulating the quality and pressure of natural gas delivered to consumers in the city of Fort Worth by all persons, firms or corporations engaged in the business of distributing such products." The Lone Star Gas Co. says that if this ordinance is valid and legally enforceable, the enforcement thereof would seriously disrupt present efficient gas service and very substantially increase the cost to consumers.

The company says the requirements of of the ordinance would not permit it to supply Fort Worth any gas from its West Texas pipe line system, which is necessary for an adequate gas service. It would also exclude Oklahoma gas normally supplied to Fort Worth.

The ordinance would limit Fort Worth's gas supply to one field and a single 300-mile pipe line from Wheeler County in the Panhandle area would be inadequate to supply Fort Worth's requirements.

"There is no provision in the ordinance regulating the delivery pressure," the company says. Under the ordinance gas could be furnished at two ounces, two pounds, or any other pressure at the consumer's meter. The provisions as to measurement would require the installation of both a recording thermometer and a recording volume and pressure gauge on every meter in the city. No utility commission or other regulatory body in the United States has ever made such a requirement. To install these instruments would entail an additional investment of more than $100 per meter or a total in excess of $3,500,000. Exclusive of any return on this additional investment, the increased operating cost required by this provision alone would be not less than $750,000 per year. To meet the unnecessary additional expense imposed by the ordinance, the company would be compelled to increase the present domestic rates more than 50 per cent.

"Under this ordinance the company is subject to a fine of $200 per day for failure to comply with any of its provisions. Service to each consumer constitutes a separate offense. As there are approximately 35,000 meters in Fort Worth and it is impossible to comply with the terms and provisions of the ordinance, we are subject to total fines of $7,000,000 per day.

SUIT FOR GAS TRESPASS

Because gas turned loose in the earth wandered into land owned by Delia Hammonds is no reason why she should recover a large sum of money from the Central Kentucky Natural Gas Co. for use and occupation of her land under the idea of trespass, the Court of Appeals has ruled in affirming the Montgomery Circuit Court. After 1919 the Natural Gas Co. exhausted the gas from a field of 15,000 acres in Menifee and adjoining counties. Thereafter, it brought in vast quantities of gas from distant fields and put it by force through its previously drilled wells into the vacated underground reservoir, withdrawing it as desired. In recent litigation the company valued these holdings at $2,000,000. Miss Hammonds is the owner of 54 acres of land within the company's boundary which never was leased to the company. She brought suit to recover what the court said was a "large sum" for use and occupation of her land, it being not disputed that the basin or reservoir underlies her land. Judgment went against her and she appealed. The Appellate Court in upholding the judgment of the lower court, in an opinion by Commissioner Osso W. Stanley, said that the wild and migratory nature of oil and gas destroys absolute ownership.

Lansing and Alma, Mich., Discussing Gas Supply

MUSKEGON, Mich., Aug. 20.—Movements for municipal natural gas systems have been started recently in two Michigan cities, Lansing the state capital, and Alma, one of the largest towns near the Mount Pleasant Field.

A resolution proposing an informal ballot by the people of Lansing at the primary election September 11 was tabled by the city council last week. The resolution proposed to enable the city to open negotiations with the Federal Government for funds to make the necessary engineering estimates for a municipal system and later for a government loan to aid in constructing the system.

A resolution adopted several nights before by the Municipal Ownership League of Lansing, and presented to the council, sought to have the council declare the Central Michigan Natural Gas Co.'s franchise void because it has not complied with charter provisions requiring a bond. The Central Michigan company for several months has been planning to pipe natural gas from Central Michigan fields to Lansing.

A resolution authorizing the city of Alma by charter amendment to operate a natural gas plant was adopted by the council and will be presented to the voters who must approve it by a three-fifths majority for adoption.

LONE STAR SUES

Suit has been filed in district court at Wheeler, Tex., by Lone Star Gas charging that American Natural Gas Co. and nine other producing company defendants in the Panhandle area had stripped gas in casinghead gasoline plants and allowed the residue gas to blow off in the air. Damages of $500,000 are sought.

TACOMA 25-YEAR FRANCHISE

A new 25-year franchise has been granted to the Washington Gas & Electric Co. of Tacoma, Wash., by the Tacoma city council, since the old franchise has expired. Under the new franchise the company must pay the city a gross revenue fee of 1 per cent for five years, and a 2 per cent tax thereafter. Under the old franchise, the company was required to pay only a yearly license fee of $1,000, and no gross revenue fees.

OHIO DISTRICTS MERGED

Consolidation of the Zanesville and Cambridge, Ohio, districts has been announced by Ohio Fuel Gas Co. Harry Baker, manager of the Cambridge district, is manager of the new district. The new district will embrace nine counties, including Guernsey, Belmont, Monroe, Noble, Muskingum, Washington, Coshocton, Tuscarawas and Perry.

Mr. Baker has been with the Ohio Fuel Gas Co. for 25 years and has been Cambridge district manager for six years.

NATURAL GAS FOR PORTLAND

N. E. Master, manager of the Master Oil & Gas Co., announces that consumers in Portland, Ind., may expect to use natural gas shortly. Pipe to carry the gas from wells drilled east of Portland to lines of the Indiana-Ohio Service Corp., supplying Portland, Winchester, and Union City, Ind., has been laid.

PERSONAL PARAGRAPHS

R. S. SHADE, of Tulsa, is enjoying a vacation near Sault Ste. Marie, Mich.

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I. C. WATSON, of Gilmer, Tex., has been added to the staff of the oil proration office at Midland, Tex.

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C. M. ANDERSON, assistant chief engineer, of the Oil Well Supply Company, spent several days in Mount Pleasant, Mich., last week.

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MISS M. E. WOLFIE, secretary of the Zingery Oil Map Company, Fort Worth, Tex., is spending her vacation visiting at her home in Dubuque, Iowa.

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J. E. HOLM, division manager, Oklahoma-Kansas division, Atlantic Oil Producing Company, is spending his vacation visiting relatives in New York and Philadelphia.

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DAVID BEACH, superintendent of the Pure Oil Pipe Line Company, Mount Pleasant, Mich., entertained his mother, of Marietta, Ohio, in Mount Pleasant last week.

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C. D. TAYLOR, assistant purchasing agent, Barnsdall Oil Company, is spending his vacation in the Arkansas and Missouri Ozarks. His family had been in the Ozarks for some weeks.

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E. C. WOLF, assistant purchasing agent, Barnsdall Company, left Saturday for Chicago to attend the Century of Progress Exposition and before returning to Tulsa will visit various points in the East.

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DON MALLOY, of Kilgore, Tex., has been made general manager of the Snowden Oil Company of that city.

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LEWIS EMERY of Bradford, Pa., is cruising amid the Greek islands with a party of 125 in a specially chartered ship.

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H. D. FELDMAN, president of Feltex Oil Corporation, Houston, Tex., has been in New York City on business.

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MR. and MRS. BLOSS A. RICHMOND, of Talara, Peru, arrived in Canada recently and are spending a couple of months in Sarnia.

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JAY P. WALKER, president, National Tank Company, Tulsa, is in Glenn Harbor, Mich., for the month of August taking a well earned rest.

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T. R. TIPTON, oil operator, of Dallas, Tex., with his family, is making a vacation trip to Banff, Alberta, and other points in the Canadian Rockies.

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P. D. MELLON, of the Canadian Western Natural Gas, Light, Heat & Power Company, of Calgary, is spending his vacation at Waterton Park, Alberta.

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DR. WILLARD F. BAILEY, geologist and former professor in the University of Missouri, has been added to the Midland, Tex., staff of the Texas Company.

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G. A. POOLE, district engineer for the Gulf Production Company in the McElroy Pool, Texas, is making an automobile trip to Massachusetts to visit relatives during his vacation.

J. P. McKEE, district geologist in Kansas for the Texas Company with offices in Wichita, is on his annual vacation.

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F. KIRK JOHNSON, of the firm of Gibson-Johnson, Inc., Fort Worth, Tex., is spending a month's vacation at Colorado Springs.

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GENE HARPER, manager of the Franklin Tool Company, Mount Pleasant, Mich., is the father of a 7-pound baby girl, born last week.

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HAROLD G. NEELY, president of the Iron Mountain Oil Company, Fort Worth, Tex., has returned from a business trip to Tulsa and Oklahoma City.

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H. W. KLEIN, general superintendent of production, Stanolind Oil and Gas Company, Tulsa, and his bride, Miss Florence Breen, are on a honeymoon in Wisconsin.

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IRA LAUGHLIN, in the scouting department of the Shell Petroleum Corp., has been transferred from Tyler, Tex., to the West Central Texas district and will probably have headquarters at Cisco.

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H. W. CAMP, general superintendent of the Empire Oil & Refining Company, and family, have returned from Creede, Colo., where they went for the annual vacation.

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H. B. CLAY, of the legal department of H. F. Wilcox Oil & Gas Company, has gone to Jefferson City, Mo., on vacation, and, accompanied by his family, will go from there to Chicago to the fair.

J. H. MOYAR, acting division superintendent for the Stanolind Oil and Gas Company, Fort Worth, Tex., is spending his vacation in Montana.

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CHARLES L. McMAHON, of Tulsa, and MRS. McMAHON, who have been on a summer tour of Alaska, are expected home about September 1.

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L. H. MURRAY, office manager for the Pure Oil Company, Fort Worth, Tex., recently spent several days at the company's main offices in Chicago.

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E. R. FILLEY, production manager for the Oklahoma-Kansas division of the Texas Company, left Tulsa several days ago for his annual vacation.

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LEE CORNELL, scout and assistant district geologist in Kansas for the Stanolind Oil & Gas Company, has gone to Columbia, Mo., for a week's vacation.

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PAUL BROOKS, sales manager for the Parkersburg Rig and Reel Company, Parkersburg, W. Va., is in Texas and the Mid-Continent on a business trip, visiting district offices.

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CARL WEINER II, son of CARL WEINER, Kansas operator, who resides in Chanute, recently underwent an operation for appendicitis at Kansas City, Mo.

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C. C. KELLEY, head of the Texas Company gasoline department, is in the Colorado Rockies on vacation. His family will go on to California for a visit.

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BEN BELT, chief geologist, Gulf Production Company, Houston, Tex. and MRS. BELT, have returned from a trip to Bruni.

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RAY LANGDON, superintendent of Texas Company activities in Kansas, with offices at Paoli, is on a two weeks' vacation.

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HARRY F. WRIGHT, engineer, Williams Brothers Well Treating Corp., Tulsa, has returned from an extended business trip in the east.

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TRONSON DRAPER, of Petrolia, Ontario, formerly western production manager of Imperial Oil, Ltd., left recently for a motor trip to western Canada.

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NEIL BUCKLEY, in charge of the Mid-Continent office at Tulsa of the Cities Service Export Oil Company, is visiting the New York headquarters of the company.

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T. E. SWIGART, vice president of Shell Petroleum Corporation, Houston, Tex., is visiting in Santa Fe, N. Mex. He has been accompanied on the trip by MRS. SWIGART.

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R. D. FARISH, Farlyn Oil Company, Houston, Tex., has been in New York City, visiting with his brother, W. S. FARISH, chairman of the board, Standard Oil Company of New Jersey.

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B. L. STRAWN, production engineer, has been made district manager for the Western Pneumatic Flow Valve Company in East Texas, establishing headquarters at Kilgore. He was formerly connected with the Hercules Supply Company in that district.

DO YOU REMEMBER?

From The Oil and Gas Journal Files

25 Years Ago

August 23, 1909

P. Kruisheer, of The Hague, Holland, is looking over the Oklahoma Field in the interest of the Anglo-Saxon Petroleum Co., a Royal Dutch-Shell company.

Underwood Nazro has been elected president of the Texas Bank & Trust Co., in Beaumont, succeeding J. E. Josey.

Frank L. Bliss, president of the Ajax Iron Works in Corry, Pa., died August 3.

20 Years Ago

August 26, 1914

The outbreak of the European war has seriously affected the oil business. Everybody seems short of cash; collections are slow, if not worse, and supply dealers are hard hit by their inability to get what is due them. Leasers and brokers are on the financial rocks, refining plants are closing or running on part time; oil companies are passing their dividends; and overproduction of crude has depressed the price. Thousands of oil workers from the Allegany fields to the Pacific Coast, have been laid off.

The Cushing Field is developing some rough and tough oil towns. A West Virginia driller shot and killed a Titusville tank builder in one ofthem the past week.

Jay O. Winger, American driller in Burma, tried to find out when oil was discovered in that country. He traced it back 300 years and then quit. Natives have been digging for it, finding it, and using it for medicine, lighting and lubricating for three centuries, he says.

10 Years Ago

August 21, 1924

The Tonkawa deep sand and the Cromwell Pool are the sensations of the summer in Oklahoma. Twelve deep sanders in Tonkawa are producing 50,000 bbls. of high gravity crude per day. Cromwell is producing 63,000 bbls. Total for the State is 521,102 bbls. Smackover, Arkansas, is producing 130,000 bbls. Powell-Mexia area 126,000 bbls., and Long Beach, California 150,000 bbls.

John C. Lineman, prominent oil man of Lima, Ohio, dies in Victoria, British Columbia, while on an automobile tour.

Up to June 30, the Osage Indians have received $53,455,603 from bonuses and royalties on oil and gas in the Burbank Field alone.

GUY E. JONES, with Halliburton Oil Well Cementing Company, recently moved from Texon to Big Springs, Tex.

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E. H. PELSTER, of the National Tube Company, has returned to Tulsa after two weeks in Colorado Springs, Denver and other Rocky Mountain resorts.

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J. S. HALLEY, assistant purchasing agent of the Stanolind Oil & Gas Company, Tulsa, left Saturday, accompanied by his family, for Cleveland, Ohio, to visit his father.

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WILLIAM MACKENZIE, of Stockport, England, is visiting relatives at Petrolia, Ontario. Mr. Mackenzie is extensively interested in the manufacture of drilling machinery.

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EUGENE G. ARMSTRONG, chemical engineer for the Sinclair Refining Company, Longview, Tex., was married in that city on August 16 to MISS ALPHA BERRY, of Seymour, Tex.

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R. N. LAMBERT, president of the Western Oil & Fuel Company, on vacation during the last three weeks, visited New Mexico points of interest and made a business trip to Texas.

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E. M. CRAIG, of the Mar Jon Oil Company, of Vancouver, British Columbia, is on a motor trip to Calgary and other Alberta points in connection with his company's drilling operations.

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E. A. SHOWERS, independent operator, Houston, Tex., and a member of the firm of Showers & Moncrief, has been in Colorado on a vacation trip. He has been accompanied by MRS. SHOWERS.

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WESTON WILSON, of the General Petroleum Corporation, whose marketing experience has carried him into every field on the Pacific Coast, has been appointed manager of wholesale domestic sales with offices at the headquarters of the company in Los Angeles, Calif.

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CHARLES C. BROWN, assistant state umpire, Oklahoma, has returned to work after recuperating from the loss of his appendix in an operation performed several months ago at Ponca City, Okla.

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R. A. BRANT, in the geological department of the Atlantic Oil Petroleum Company, Tulsa, is spending his vacation in the far east attending archery matches in Connecticut and other New England states.

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PAT REGAN, petroleum engineer in East Texas for the Stanolind Oil and Gas Company, with headquarters at Willow Springs, is spending his vacation in Denver, Colo. He is a graduate of the Colorado School of Mines.

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JAMES H. GARDNER, president, Gardner Petroleum Company, Tulsa, is on his way back from a vacation trip spent touring in New Mexico from the Carlsbad Caverns northward. His sons accompanied him.

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ROBERT A. HUNTER, with the Pure Oil Pipe Line Company in the Montcalm County Field, Central Michigan, was on a motor trip through East Pennsylvania and West Viriginia last week. He formerly was employed in these fields.

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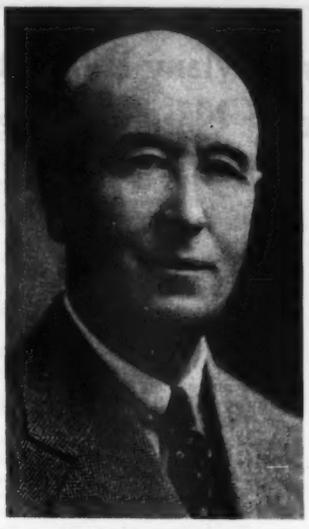
P. F. CERVENY, of Palestine, Tex., has been transferred to Caldwell, Kans., as manager of a Gypsy Oil Company seismograph party working out of that place. He replaces E. M. PALMER, who has been transferred to a party stationed at Guthrie, Okla.

FIRST FILLING STATION WAS A MARVEL

C. M. Rolston, of Vancouver, British Columbia, who last April joined the ranks of Imperial Oil, Ltd., annuitants after 40 years of service, possesses the distinction of having opened in Vancouver 26 years ago the first filling station in Canada, probably the first in the world.



C. M. ROLSTON

This pioneer station consisted of a hot-water boiler mounted on a wall and equipped with a hose. Gasoline was kept in the improvised tank for the occasional owners of "horseless carriages" who needed fuel. The motorist would drive up, the quantity of gasoline he wanted would be run out through the hose and poured into the old-fashioned tank beneath the front seat, and thus serviced the horseless carriage would go chug-chugging on its way. Mr. Rolston's primitive outfit was improved rapidly with the increased demand for gasoline.

A native of London, Ontario, Mr. Rolston received his education in that province. He became a salesman for Imperial Oil in western Canada, with headquarters in Winnipeg. Later he was sent to Port Arthur, Ontario, to report on mining developments for the company. The results of his efforts in the northern Ontario mining area led the company to send him farther west. For a time he was the only Imperial Oil representative west of Regina. Later he was located in Vancouver with jurisdiction over the territory between Calgary and Victoria, but as the country developed he was given charge of British Columbia.

Under Mr. Rolston's direction the Vancouver division of Imperial Oil, Ltd., steadily developed in importance. Much of the work in early days was of a pioneering nature, involving long journeys by railroad, stage and saddle into remote forest or mining areas or by tugboats to canneries, coal mines and logging camps on the coast.

It was some six years after taking charge in Vancouver that Mr. Rolston conceived the idea of a filling station, which since then has been so widely adapted and improved.

On his retirement Mr. Rolston received an illuminated address, with tickets for several thousand miles of ocean travel for himself and Mrs. Rolston from the British Columbia staff. He also was presented in behalf of the Imperial Oil directorate with a 40-year service button set in diamonds.

BERT LIGON, sales manager for the Wilson Manufacturing Company, Fort Worth, Tex., recently spent several days at the company's main offices in Chicago.

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C. L. BENEZETTE, manager of the Mount Pleasant, Mich., store of the Oil Well Supply Company, was married last week to MISS HELEN SCHILLACI, of Muskegon, Mich., where Mr. Benezette formerly was Oil Well Supply Company manager.

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W. H. GEIS has been elected chairman of the code allocation committee, a subcommittee of the Central Committee of California Oil Producers, succeeding A. C. RUBEL, who recently resigned due to the press of other matters. The subcommittee as now constituted consists, in addition to the chairman, of LLOYD WILLIAMSON, R. R. McGUIRE, LAWRENCE KELLY, J. U. STAIR, WARNER CLARK, and EMIL KLUTH.

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L. A. OGDEN, assistant division superintendent, Pure Oil Company production department, Tulsa, has returned from a vacation trip to California with his wife, mother and two children. Driving home through eastern Colorado their automobile left the highway and turned over several times after the left rear tire blew out. Mrs. Ogden sustained a double fracture in her right arm, Mr. Ogden had the fleshy part of his right heel torn loose, and his mother received a scalp wound. After first aid treatment in a hospital at Las Amimas, Colo., the party flew into Tulsa and Mrs. Ogden is now in St. Johns Hospital, but Mr. Ogden is back on the job using crutches.

A. T. SCHERER, of the Sinclair Prairie gasoline department, Tulsa, has returned from Michigan, where he has been vacationing for the last three weeks.

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C. B. SINGLETON, of St. Louis, Mo., general purchasing agent for the Shell Petroleum Corporation, was in Tulsa last week, visiting the Shell purchasing offices.

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HARRY NORRIS, Sinclair Prairie scout at Oklahoma City, Okla., and formerly in charge of the old Prairie scouting department in Tulsa, has gone to the World's Fair at Chicago with MRS. NORRIS and baby.

• • •

W. H. MORRISON, area exploitation engineer for Shell Petroleum Corporation, returned to Tulsa after a field trip and inspection of the company's properties in the Texas Panhandle.

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W. C. JOSEY, president of the Rancho Oil Company, and also of the Gem Oil Company, Fort Worth, Tex., is on vacation in Canada and the Rocky Mountain states, also attending the Century of Progress at Chicago.

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ERNEST E. BLINCOE, member of the Kansas Corporation Commission, Topeka, Kans., was the principal speaker at the monthly meeting of the Kansas Chapter of the American Petroleum Institute, held in Wichita, Kans.

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CHARLES FITZGERALD, assistant to the chairman of the board, and president of the Sinclair Prairie Pipe Line Company of Texas, is making a four weeks' trip with MRS. FITZGERALD to points in Canada and the Northwest.

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C. M. BENNETT, vice president of the Magnolia Petroleum Company, in charge of the land and geological departments, has been confined to Baylor Hospital, Dallas, Tex., for the past week. He is now at home and feeling much better.

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EVERETT MEADERS, manager of the crude oil purchasing department in Kansas for the Stanolind Crude Oil Purchasing Company, is taking a two weeks' vacation in the Lake of the Ozarks region of Missouri.

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FRANK H. DUNN, vice president of the H. F. Wilcox Oil & Gas Company, Tulsa, left Saturday for Pittsfield, Mass., to join MRS. DUNN and children, who have been there since early in the summer.

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MAX W. BALL, independent geologist and oil and gas engineer, of Denver, Colo., is making a survey of natural gas reserves in the Austin Township, Mecosta County Field in Central Michigan, for the American-Michigan Pipe Line Company, of Muskegon, Mich.

• • •

EDWIN PAULEY, president of the Petrol Corporation of California with offices in Los Angeles, has joined the rapidly increasing group of oil men who have gone in for yachting. Mr. Pauley's new vessel is the "First Adventure" but he is going to change the name to "Finesse" which should be more in keeping with his mastry of contract bridge.

• • •

LEE SCOTT, manager of the land and lease department of Vickers Petroleum Company of Wichita, Kans., has resigned. He has been succeeded by PERRY HANSON, formerly geologist with the Vickers company. Mr. Scott has been engaged in Kansas oil since 1915, being with the Eagle Oil Corporation before joining the Vickers company.

NATURAL GASOLINE MANUFACTURE

Stabilization Committee Studies Plan for Natural

The scheduled meetings of the new stabilizing committee, formed for the purpose of holding the prices of motor fuel at a reasonable and somewhat constant level over the future and as an aid to the Planning and Coordination Committee in consolidating the gains made under the oil code may be construed as an exceptionally constructive move so far as natural gasoline is concerned.

The formation of the stabilizing committee was announced a week ago and it is made up of men familiar with natural gasoline from a manufacturing as well as marketing standpoint. The committee has for its immediate objective the stabilizing of refinery motor fuel prices and the plan outlined for the stabilizing of refinery gasoline prices in East Texas through major company purchases by contract will probably serve as the basis for the new expanded plan of purchasing distress material whereever it may appear.

It becomes apparent that in order to make the plan effective, control must be placed upon production and if it is to be made effective it must consider the problems natural gasoline injects into the market picture. A plan for monthly purchases of natural gasoline by major refiners throughout the country has been evolved and is now being considered by the Planning and Coordination Committee. The answers received on a questionnaire sent to every natural gasoline manufacturing company served as the basis for the plan and within a week or two something definite is expected to come from Washington in the form of a general plan which will include the purchase of distress natural.

JUNE EXPORTS INCREASE

Exports of natural gasoline for June, 1934, showed an increase over the May movement. The United Kingdom and Canada absorbed all of the exported product totaling 166,528 bbls. and valued at $313,556. In May, Canada imported all but 21 bbls. of the 111,781 bbls. which went to Mexico. The bulk of natural gasoline in June was cleared from New Orleans and Los Angeles, and small shipments cross the Canadian border at six different points.

The total amount exported was 166,528 bbls., valued at $313,556. A detailed table of the exports follows:

PURCHASES OF U. S. NATURAL GASOLINE

	1934	
	June	May
United Kingdom	$4,195	.....
Canada	32,333	111,760
Mexico	.....	21
Total quantity	166,528	111,781
Total value	$313,556	$204,486

CUSTOMS DISTRICTS THROUGH WHICH CLEARED

	1934	
	June	May
St. Lawrence	461	723
Buffalo	2,696	2,729
Sabine	19,445	33,401
Los Angeles	44,976	45,665
Montana and Idaho	973	390
Dakota	6,213	6,795
Michigan	6,793	10,321
Duluth and Superior	771	....
New Orleans	84,195	....
San Antonio	.....	6
El Paso	.....	15
Minnesota	.....	736
Total	166,528	111,781

Gas Tester Overcomes Many Difficulties in Determining Use of Natural Gases

In the oil fields the epithet, "gas tester," is one of no mean significance, according to the Phillips Shield, house organ of the Phillips Petroleum Co. Gas testers, it says, are professional men of which the public seldom hears, men who on occasion have epic experiences in their line of duty and who frequently find themselves among the modern pioneers in the oil industry. They carry their apparatus on their backs, figuratively speaking, depart from the conveniences of the city, waive the surroundings of the laboratory, and perform the duties required of them often in the face of unfriendly elements and under trying circumstances. Rainy weather, impassible roads, wintry blizzards, lack of living accommodations and futility of effort are only a part of the common experiences of these men. Courage and perseverance are essential strains in their make-up.

The duties of the gas tester are many and varied. He measures the flow of gas from wells where no ordinary means of measurement are available. He determines the character of the gas. He discovers what usable products are present, and also what impurities or objectionable constituents there may be, and he must ascertain in what quantities any of these elements exist.

Natural gas, contrary to common opinion, is not a single, pure substance of unvarying characteristics. It rarely consists of a single chemical component, but on the contrary is usually made up of a considerable number of definite chemical compounds, called hydrocarbons, of which methane is, normally, the most abundant. In addition such other substances as dirt or fine solid suspended matter, water vapor, nitrogen, carbon dioxide, air, or hydrogen sulphide may be present in effectual quantities.

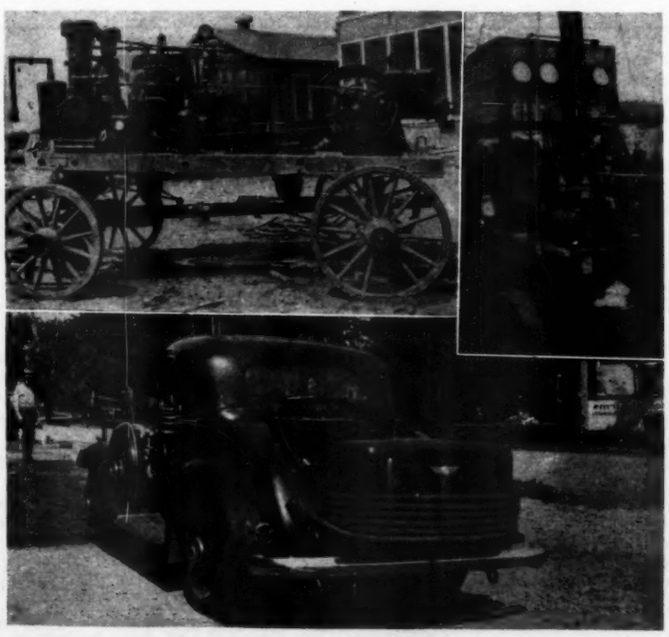
In the commercial use of natural gas it is very important to know the quality of the gas before exploitation is begun because the kind and quantity of its constituents markedly control its heat value, the economy with which it may be processed to obtain desirable products, its deleterious action upon the pipe lines through which it may be transported or upon the burning equipment or other apparatus in which it is used, or the hazard to human life. Some natural gases actually will not burn, while others have extremely great heating values. Some may contain large quantities of carbon dioxide from which dry ice may be manufactured directly, while large quantities of gas encountered in the Mid-Continent oil fields bear, in varying proportions, hydrogen sulphide which gives to the gas a pronounced odor of freshly broken, extremely decayed eggs and renders it quite poisonous under many circumstances or largely unfit for most commercial uses. Still other gas, found in all parts of the country, contains certain hydrocarbon components which are relatively easily separated from the gas, reduced to liquid form, and handled in such condition under normal temperatures and moderate pressures. It is of these latter easily liquefiable hydrocarbons that "natural gasoline," an important constituent of modern motor fuel, consists.

Various and intricate apparatus must be used by the gas tester in exploring the secrets of natural gas from a new well or field, or from wells in an area from which it becomes desirable to use the gas. He goes to his work more or less blindfolded and must determine with exactitude the components of the gas, and, with the greatest accuracy possible, the quantities of desirable or detrimental constituents. Many of his tests must be made in the field right at the well while others require the careful selection of samples from which laboratory tests may be made. He must often go great distances from his base of supplies, equipped with all of the paraphernalia he may need over a period of some days or weeks. Many tests require laborious efforts in approaching gas wells far from the beaten trails, or call for lugging pipe, single-handed, with which gas from wells otherwise inaccessible may be piped within reach of his apparatus.

Great skill is developed by these men in ferreting out the problems to which they are assigned. Many of them claim from the mere whiff of a gas to be tested, that they can tell you, for instance, the quantity of natural gasoline which can be extracted from it. Others, with uncanny accuracy, can name the quantity of natural gas roaring from an open pipe or from the mouth of a well many of which exhibit such furore of escaping gas that the ears must be sealed for protection against bursted ear drums.

The gas tester must be imbued at once with the capabilities of a chemist, a mechanic, a petroleum technician, a philosopher and a saint. He must be a highly skilled expert, with versatility and patience. On his judgement and the accuracy of his tests millions may be wagered, won or lost! His is the lure of the unknown and he works with the knowledge that his efforts are of no small importance to the complicated economic structure of which he is a part.

A common method for determining the quantity of natural gasoline in gas is by means of compression apparatus, wherein samples of gas are passed through a compressor, elevated to high pressure, and then cooled in a coil submerged in ice water. Such apparatus is usually mounted on an automobile, built integrally into the car structure, and operated, by means of an auxiliary drive, directly from the engine of the automobile.



Upper left—An early horse-drawn test outfit showing the cooling water barrels, the compressor, and the gasoline engine motive power. Upper right—An early, continuously operating, test wagon in which a certain absorption oil was used. Cocoanut charcoal has replaced this as an absorbing medium. Lower—A modern test car equipped for accurate work and with all apparatus of light construction

SMITH BROTHERS OPERATIONS

Hanlon-Buchanan, Inc., natural gasoline operators, in connection with the Smith Brothers Refining Co., are developing several oil-producing properties in Wheeler County, Texas. Their No. 1 Harlan, completed about 30 days ago, produced an average of 1,007 bbls. on a five-day proration test. The location of this well is NE cor. W half Section 49, H.&G.N. Survey, Wheeler County. No. 3, one location south, is now on a five-day test and promises to be as good as No. 1. No. 2, one location west of No. 1, is on top of pay and is drilling in. The formation, gas volume, and pressure checks with Nos. 1 and 3. A rig is being built for No. 4 offsetting the Shell Petroleum Corp., which well is not completed.

Additional offsets, occasioned by Champlin, Christie and Hickman as well as Shell, will require the starting of Nos. 5 and 6 within a few days. The same interests have completed a good producer in Section 45 offsetting Kelly and others and own acreage in other proven territory in Wheeler and Gary Counties. Hanlon-Buchanan, Inc., has a half interest in these properties along with the Smith Brothers Refining Co.

Uncertainties Keep Petroleum Markets in Chicago Area in Unsettled State

By SPECIAL CORRESPONDENT

CHICAGO, Aug. 20.—Uncertainties over major company stabilization and buying plans, over labor troubles in the industry, over the effects of the middle western drouth and over other questions are combining to keep the petroleum markets here in a state of unsettlement. The principal constructive factor continues to be gasoline consumption which is holding up at a good rate for the territory as a whole.

The Labor Day holiday is being awaited by the trade as a period of heavy demand, and with this in mind jobbers have taken stock of their situation and have ordered out material to reach them late next week. As for some time past, jobbers are operating on an extremely hand-to-mouth basis. Their stocks have been kept far down and they are specifying rush action on most of the orders they place, whether on contract or in the spot market.

Expect Good Demand

On the whole, retail gasoline business in the Middle West has been good through the summer, although disquieting reports of the effects of the dry, hot weather in specific sections continue to come out. General feeling of conservative people is that the consumer demand in the early fall will be comparatively good. However, tank wagon and service station prices remain badly cut up, at some main station points but especially at smaller towns, thus reducing the profit element.

Gasoline is being offered by various sellers along about the same lines as have been noted for some weeks past. Most of the more pressing offers continue to emanate from East Texas, but some doubt is now expressed in well-informed trade circles as to shipment of some of the material involved in view of the recent holding up of some material from delivery out of that region. Another source of offers reaching jobbers in the Central States in North Texas and some little material seems to be seeping out of Oklahoma below the generally accepted market. The Kansas situation on the other hand appears to be quite strong at the moment. In the latter State considerable improvement in the tank wagon and service station price structure has been worked out in the last few days.

Committees Busy

Stabilization committees are getting busy on the question of price wars over large sections of the country, although current reports indicate they have tackled a tremendous task. Much hope is expressed, however, for a better market situation in the coming weeks. Opinion here is that tank car and tank wagon service station markets will have to be stabilized rapidly to prevent trouble in crude oil prices.

Generally, tank car gasoline prices have not changed their complexion greatly here lately. Much talk of extremely low prices is heard, but it is hard to develop that any great amount of business is being transacted at such prices. Most carlot marketers say they are staying on the sidelines, watching developments. It is felt by many interests that development of widespread buying power in an extensive pool might see a firming of tank car prices in a comparatively short time.

Kerosene

With gasoline somewhat uncertain, kerosene also is in a rather unsettled price zone. Buying has not been very aggressive nor very important in the total amounts involved. Stocks, however, do not appear to be especially burdensome and tone is holding up comparatively well.

Crude Oil Prices

(Continued from Page R-25)

Effective September 29 in Salt Flat by Shell Petroleum Corp.

Rocky Mountain States

Iles, light (Sept. 29, 1933)	$.96
Iles, heavy (September 29, 1933)	.90
Florence, Colo. (June 17, 1933)	.30
Fort Collins and Wellington, Colo. (June 17) .....(See Salt Creek prices)	
Big Muddy (Sept. 29, 1933)	1.01
Frannie, light (May 1, 1934)	.70
Frannie, heavy (Sept. 29, 1933)	.62
Salt Creek and LaBarge (Sept. 9, 1933) See Stanolind Mid-Continent price schedule	
Grass Creek, light (Sept. 29, 1933)	1.18
Grass Creek, heavy (Dec. 15, 1933)	.45
Elk Basin (Sept. 29, 1933)	1.18
Rock Creek (Sep., 29, 1933)	1.02
Dutton Creek (July 8, 1933) .....See Mid-Con inent gravity prices	
Lance Creek (Dec. 16, 1932)	.92
Poison Spider (Mar. 5, 1931)	.70
Hudson (June 2, 1931)	.65
Lander (Mar. 5, 1931)	.40
Rex Lake (Feb. 22, 1930)	1.10
Osage	1.08
Lost Soldier (Sept. 30, 1933)	.88
Hamilton Dome:	
Below 18° (July 1, 1934)	.52
18° and above (July 1, 1934)	.62
Torchlight (Sept. 29, 1933)	1.18
Greybull (Sept. 29, 1933)	1.18
Pondera	1.15
Sunburst (Sept. 29, 1933)	1.35
Cat Creek, Montana	1.07
Hogback (Sept. 29, 1933)	1.11
Lea County, N. Mex. (Sept. 29, 1933)	.75
Maljamar (Sept. 29, 1933)	.70
Artesia-Jackson (Dec. 1, 1933)*	.75

Note—Salt Creek, Torchlight, Elk Basin, Grass Creek, Frannie, Greybull, Hogback and Iles by Stanolind Oil & Gas Co. Elk Basin, Grass Creek light, Big Muddy, Rock Creek and Sunburst by Ohio Oil Co. Lost Soldier posted by Producers & Refiners Corp. Artesia, Jackson and Maljamar posted by Continental Oil Co. Lea County, effective September 29, 1933, by Humble Oil & Refining Co. and other buyers; Fort Collins, Wellington, Orchard, Florence, Big Muddy, Cat Creek, Rattlesnake and Table Mesa by Continental Oil Co. Osage posted by Arro. Hamilton Dome, Wyo., by Stanolind Oil & Gas Co.

*Continental Oil Co.

North Louisiana and Arkansas

Smackover, Ark. (all grades)	$.70
Tullos, Urania, La., (Jan. 13, 1934)	.87
Nevada, Ark. (Sept 29, 1933)	.60
East El Dorado (Sept. 29, 1933)	.70
Converse, La. (Mar. 17, 1934)	1.03
Elm Grove, La. (Sept. 29, 1933)	.75
Holly, La. (Nov. 17, 1934)	1.03
Pleasant Hill, La. (Mar. 17, 1934)	1.03
Zwolle, La. (Mar. 17, 1934)	1.03
Champagnolle, Ark. (Mar. 17, 1934)	.81
Lisbon, Ark. (Mar. 17, 1934)	1.03
Stephens, Ark. (Sept. 29, 1933)	.70
Urbana, Ark. (Mar. 17, 1934)	.60
Other fields .....(See gravity table)	

Note—Smackover: Effective September 29, 1933, Texas Co., Magnolia Petroleum Co., Standard of Louisiana, Louisiana Oil Refining Corp., Gulf Refining Co. and Phillips Petroleum Co. East El Dorado posted by Magnolia Petroleum Co. and Gulf Refining Co., Nevada by Standard Oil Co. of Louisiana. Urbana posted by H. L. Hunt, Inc., and Louisiana Oil Refining Co. Converse, Holly, Zwolle and Urbana by Standard Oil Co. of Louisiana; Elm Grove by Simmons Oil & Refining Co.; Pleasant Hill by Standard Oil Co. and Magnolia Petroleum Co.; Champagnolle by Standard Oil Co. and Lion Oil & Refining Co.

Eastern States

TIDE WATER PIPE CO.
(Effective May 1, 1934)

Bradford, Pa.	$2.55
Alleghany, N. Y.	2.55

SOUTH PENN OIL CO.
(Effective May 1, 1934)

Pennsylvania Grade Oil in National Transit Lines (Bradford Field)	$2.55
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.32
Pennsylvania Grade Oil in Eureka Pipe Line lines	2.17
Pennsylvania Grade Oil in Buckeye Pipe Line lines	2.07
Corning Grade Oil in Buckeye Pipe Line Co.'s lines (Oct. 2, 1933)	1.32

PENNZOIL CO.
(Effective May 1, 1934)

Pennsylvania Grade Oil in National Transit Lines:	
Group A (Includes Cochran, Franklin, Hamilton and Doolittle districts.)	$2.47
Group B (Includes Titusville district.)	2.40
Group C (Includes Turkey and Tidioute districts.)	2.40
Group D (Includes Bear Creek and Porkey districts.)	2.44
Group E (Includes Eideneau, Bull Creek, Rough Run, Carbon, Dipner, Bredin, McJunkin, Jameson, Kennerdell, Emlenton, Tiona, Lacey and Kinzua districts. Price depends on length of pipe line haul to plant at Oil City.	2.42

PURE OIL CO.
(Effective May 1, 1934)

Cabin Creek, W. Va.	$2.17
Bradford Hollow, W. Va.	2.17
Kelly Creek, W. Va.	2.17

Middle Western States

OHIO OIL CO.
(Effective September 29, 1933)

Lima	$1.30
Illinois (Jan. 5, 1934)	1.13
Princeton, Ind. (Jan. 5, 1934)	1.13
Plymouth	Shut in
Western Kentucky (May 26, 1934)	$1.08
Midland, Mich. (Sept. 30, 1933)*	1.02
Oceana, Mich. (Oct. 5, 1933)	.90
Somerset, Ky. (Sept. 30, 1933)	1.23
Hart County, Ky. (Oct. 1, 1933)	1.18

*Posted by Pure Oil Co. Producers Pipe Line Co. pays 5 cents per barrel over Pure Oil Co.'s posted price. Somerset, Ky., crude purchased by Ashland Refining Co., Ashland, Ky., and posted price includes premium. Hart County, Kentucky, crude purchased by Stoll Refining Co. Oceana posted by Old Dutch Refining Co. and Naph-Sol Refining Co.

Canada

Ontario (September 9, 1933):	
Petrolia*	$2.10
Oil Springs	2.17
Turner Valley (May 21, 1934):†	
Clear naphtha	$2.55
Discolored naphtha	2.37
Crude oil, 50 gravity	2.19
Crude oil, 45 to 49.9	2.07
Crude oil, 40 to 44.9	1.50

*Imperial Oil, Ltd. †Imperial Oil, Ltd., and Regal Oil & Refining Co.

Mexico

Panuco*	$0.94

*F.o.b. ship, based on May transactions and exclusive of production and export taxes and bar dues.

California Crude Oil Prices

STANDARD OIL CO. OF CALIFORNIA
(Effective September 6, 1933)

For current purchases of crude oil at the well (unless otherwise specified.) (All gravities above those quoted take highest price offered in that field.)

Gravity—	Long Beach	Seal Beach, Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda, Brea Canyon	Athens-Rosecrans	Torrance	Richfield	Whittier, La Habra	Montebello	Santa Fe Springs	La Habra-Coyote	Midway-Sunset Elk Hills, Buena Vista Hills	Lost Hills	Coalinga	Coyote
14-14.9	$.65	$.65	$.65	$.65	$.65	$.65	....	$.65	$.65	$.65	$.65	....	$.65	$.67	$.67	$.67	$.66
15-15.9	.65	.65	.69	.69	.66	.69	....	.66	.65	.65	.65	....	.65	....	....	....	.65
16-16.9	.66	.66	.72	.72	.68	.72	....	.69	.67	.66	.65	....	.65	....	....	....	.65
17-17.9	.69	.66	.76	.76	.72	.76	....	.72	.70	.71	.65	....	.68	....	....	....	.68
18-18.9	.72	.65	.78	.80	.76	.79	....	.75	.74	.74	.65	....	.71	.61	.61	.59	.71
19-19.9	.75	.65	.81	.83	.80	.82	....	.78	.78	.78	.65	....	.74	.64	.65	.62	.74
20-20.9	.78	.68	.83	.87	.83	.85	....	.81	.82	.81	.66	....	.78	.67	.69	.65	.78
21-21.9	.81	.72	.86	.90	.87	.88	....	.83	.85	.84	.69	$.72	.81	.70	.73	.68	.81
22-22.9	.84	.76	.89	.94	.90	.92	....	.85	.89	.87	.72	.76	.84	.73	.76	.72	.84
23-23.9	.88	.81	.92	.97	.94	.95	$.93	.89	.93	.90	.76	.79	.87	.77	.79	.75	.87
24-24.9	.91	.85	.95	1.01	.97	.98	.86	.92	.97	.93	.80	.83	.90	.81	.82	.78	.90
25-25.9	.94	.89	.98	....	1.00	1.01	.90	.95	1.00	....	.85	.87	.93	.85	.85	.81	.93
26-26.9	.97	.93	1.01	....	1.04	1.04	.94	.98	1.04	....	.89	.90	.96	.89	.88	....	.96
27-27.9	1.00	.98	1.04	....	....	1.07	.97	....	1.08	....	....	.94	.99	.93	.91	....	.99
28-28.9	1.03	1.03	1.07	....	....	1.10	1.01	....	1.11	....	....	.98	1.02	.97	.94	....	1.02
29-29.9	1.06	1.05	1.09	....	....	....	1.04	....	1.15	....	....	1.01	1.05	1.01	.97	....	1.06
30-30.9	1.09	1.10	1.13	....	....	....	1.08	....	....	....	....	1.05	1.09	1.05	1.00	....	1.09
31-31.9	....	....	....	....	....	....	1.12	....	....	....	....	1.08	1.12	1.09	....	....	1.12
32-32.9	....	....	....	....	....	....	1.16	....	....	....	....	1.12	1.16	1.12	....	....	1.16
33-33.9	....	....	....	....	....	....	....	....	....	....	....	1.16	1.18	1.17	....	....	1.18
34-34.9	....	....	....	....	....	....	....	....	....	....	....	1.19	1.21	....	....	....	1.21
35-35.9	....	....	....	....	....	....	....	....	....	....	....	1.22	....	....	....	....	....
36-36.9	....	....	....	....	....	....	....	....	....	....	....	1.26	....	....	....	....	....
37-37.9	....	....	....	....	....	....	....	....	....	....	....	1.30	....	....	....	....	....
38-38.9	....	....	....	....	....	....	....	....	....	....	....	1.34	....	....	....	....	....

Additional Standard Oil Quotations

Mountain View—Effective July 3, 1934, the following are the prices of the Standard Oil Co. of California for its current purchases of crude oil at the well in the Mountain View Field: 14 to 19.9 degrees, 57 cents; 20-20.9, 58 cents; 21-21.9, 59 cents; 22-22.9, 61 cents; 23-23.9, 63 cents; 24-24.9, 66 cents; 25-25.9, 69 cents; 26-26.9, 72 cents; 27-27.9, 75 cents; 28-28.9, 78 cents; 29-29.9, 81 cents; 30-30.9, 84 cents; 31-31.9, 87 cents; 32-32.9, 90 cents; 33 degrees and above, 92 cents.

Elwood Terrace—F.o.b. ship, 23 degrees, $1.03; 24 degrees, $1.06; 25-25.9, $1.09; 26-26.9, $1.13; 27 degrees and over, $1.16.

Newhall—14 degrees and over, 57 cents.

McKittrick and Kern River—14 degrees and over, 57 cents.

Wheeler Ridge—14 to 17.9 degrees, 57 cents; 18-18.9, 58 cents; 19-19.9, 61 cents; 20-20.9, 64 cents; 21-21.9, 67 cents; 22-22.9, 70 cents; 23-23.9, 73 cents; 24-24.9, 76 cents; 25 degrees and over, 79 cents.

Kettleman Hills—32-32.9 degrees, 93 cents; 34-34.9, 96 cents; 35-35.9, 99 cents; 36-36.9, $1.02; 37-37.9, $1.05; 38-38.9, $1.08; 39 degrees and over, $1.11.

The Texas Co. posted in Shiells Canyon, South Mountain and Santa Paula as follows: 14 to 17.9, 57 cents; 3 cents added for each degree up to and including 26-26.9 degrees at 84 cents; then 4 cents added for each degree up to and including 30 degrees and over at $1. Company posts Standard Oil Co.'s Montebello prices in Montebello and North Whittier, and posts Standard Oil Co. prices in Signal Hill, Alamitos Heights, Huntington Beach, Torrance, Richfield and Santa Fe Springs, all effective September 6.

General Petroleum Co. posts Standard Oil Co. prices in Athens, Rosecrans and Signal Hill; Alamitos Heights up to 26-26.9; Santa Fe Springs up to 35-35.9; Richfield up to 25-25.9; Brea Canyon and Olinda up to 25-25.9, and Torrance up to 25-25.9.

Union Oil Co., effective September 6, posts same price as Standard Oil Co. in all fields in which both purchase, excepting that in Athens-Rosecrans, Union Oil Co. posts 21-21.9, 72 cents, and 33-33.9, $1.18; 34-34.9, $1.21, and 35-35.9, $1.24.

Associated Oil Co., effective September 6, posted same prices for the same grades as Standard Oil Co. of California, excepting that in some fields its gravity scale stops as follows: Huntington Beach, 26 degrees and over; Seal Beach and Alamitos Heights, 26 degrees and over; Coyote Hills, 23 degrees and over; Richfield, 25 degrees and over; Torrance, 25 degrees and over; Inglewood, 24 degrees and over; Santa Fe Springs, 35 degrees and over; Midway-Sunset, Elk Hills, Buena Vista Hills, 39 degrees and over. Also Associated pays 52 cents for oil of 11 to 13.9 gravity in McKittrick, Kern Front, Kern River, Midway-Sunset, Elk Hills, Buena Vista Hills and Coalinga.

California Fields

(Continued from Page 311)

feet but the output is cutting about 10 per cent.

In the Ventura Avenue Field the Shell Oil Co. swabbed in No. 77 Taylor flowing 4,600 bbls. per day from 9,482 feet but this new well showed such a high water cut that the well was killed in order to undertake remedial work. In the meantime, the Associated Oil Co.'s No. 133 Lloyd, which is projected for completion in the deep 57 zone, is being held up with mechanical trouble at 9,218 feet. The General Petroleum has reached a depth of 6,501 feet in No. 13 Notten, which like the other two wells just mentioned is destined for completion in the deep 57 zone discovered by the Associated Oil Co. a few years ago. In the San Miguelito Field of Ventura County, the Continental Oil Co. is still rotating in No. 3 Grubb in oil sand. This well, based on the results obtained to date, apparently extends the San Miguelito Field another 1,000 feet as far as proved acreage is concerned.

Kettleman Hills

Superior Oil Co. has finished its last well in the North Dome of the Kettleman Hills Field and this project, which was plugged back to the Temblor following an unsuccessful attempt to carry it down to the Eocene, was brought in flowing approximately 10,000 bbls. of crude oil per day from 8,990 feet after the hole had been plugged back from 9,231 feet. Exact production is not yet available as the production test is still under way at present. The Union Oil Co. topped the Temblor in No. 6 King at 7,549 feet and this well should consequently be tanking oil some time before the close of September. No. 7 King is about 1,000 feet behind No. 6 and will, barring the development of mechanical trouble, be finished around October 1.

Standard Oil Co.'s No. 6-33-J, a recent completion in the North Dome, registered a potential daily production of 7,347 bbls. of clean 36.2 gravity oil and 7,450,000 feet of gas.

Oklahoma Fields

(Continued from Page 304)

is estimated to be good for 20 bbls. a day on the pump. Texas Co.'s No. 5 Mobley, SE SW NE Section 24-4s-3w, deepened to 2,062 feet, made a 1-bbl. pumper with 10 bbls. of water per day.

Samedan Oil Co.'s No. 2 Higgins, NE NW NE Section 36-1s-3w, Carter County, was dry and abandoned at 2,744 feet.

In Stephens County, Magnolia Petroleum Co.'s No. 18 Dillard, 150 feet north and 810 feet east of C Section 2-2s-5w, deepened from 452 feet to 688 feet, increased its production to 8 bbls. per day and was completed. No. 18 on the lease, 150 feet north and 1,170 feet east of center of same section, was deepened from 436 feet to 683 feet and increased production to 7½ bbls. per day. It was completed. L. Sykes' No. 2 Mulkey, C W half E half NE Section 16-1s-8w, pumped 3 bbls. of oil and 75 bbls. of water from sand at 2,119-24 feet and was completed. No. 3 Mulkey, SW NE NE Section 16-1s-8w, is also a small well, starting at 5 bbls. from sand at 2,030-40 feet.

Gulf Coast Fields

(Continued from Page 309)

The well is producing from a sand at a total depth of 7,045 feet, and is making around 50 bbls. of distillate daily. A Canadian buyer is taking the output, the distillate being moved by tank car.

A deep test is to be started on a 5,000-acre block obtained on Galveston Island by H. E. Sedberry, trustee. Location has been made on the Thomas Shaw 200-acre tract in Lot 66, Section 7, Hall & Jones Survey, at the extreme west end of the island and across the bay from the Rattlesnake Mound prospect. The Galveston test is being drilled on the strength of geophysics and on shallow oil showings encountered in a test drilled in 1902, a log of which has just been found. The test was abandoned at 1,400 feet. In 1924 Magnolia Petroleum Co. drilled a test there, going to 4,615 feet, where it was abandoned.

Kansas Wildcats

(Continued from Page 306)

Wenzel et al's No. 1 Schrag, NW SE Sec. 26-22-3w.
Spudded and S.D.

KINGMAN COUNTY

W. C. McBride, Inc.'s No. 1 Wolbridge, NW SE Sec. 16-27-7w.
Drlg. 3,082 ft.

McPHERSON COUNTY

Marileen Oil and Gooring Bros.' No. 1 Decker, NW cor. SE Sec. 20-15-1w.
T.D. 2,600 ft.; fishing.

Tom Palmer and Phillips Pet. Co.'s No. 1 Moddelmog, NE NE NW Sec. 2-21-1w.
Set 15-in. pipe 732 ft.; drlg. 1,738 ft.

OSAGE COUNTY

Jim Edwards' No. 1 Detrich, C NW SE Sec. 21-14-15.
Rigging up.

OSBORNE COUNTY

Carmen & Hershey's No. 1 Fritz, C NE NE Sec. 9-10-14w.
S.D. 700 ft.

RENO COUNTY

Foraker et al's No. 1 Hiett, SE SW NE Sec. 34-24-4w.
Ponds and cellar.

Hartman Oil et al's No. 1 Stone, C NW NW Sec. 15-24-4w.
Drlg. 2,112 ft.

L. H. Wentz' No. 1 Metcalf, SE NE SW Sec. 3-24-7w.
Chat 3,696-98 ft.; S.W.; U.R. 6-in. csg.

Sinclair Prairie Oil Co.'s No. 1 Shepard, SE cor. NW Sec. 22-26-9w.
Siliceous lime 4,333-43 ft.; 2,500 ft. W.I.H.; T.D. 4,469 ft.; S.D.

Washoma O. & G. Co.'s No. 1 Crotts, NE NW NE Sec. 27-26-10w.
Abd. 266 ft.

RICE COUNTY

Darby Pet. Co. et al's No. 1 Taylor, NW SE SW Sec. 25-19-8w.
Drlg. 1,970 ft.

Deitrick et al's No. 1 Fitzpatrick, C NE NE Sec. 30-21-8w.
2,830-34 ft., small show oil; running 6-in. csg.

Gypsy Oil Co.'s No. 1 Gibson, SW NW NE Sec. 4-21-10w.
Drlg. 2,145 ft.

Elwell et al's No. 1 Porter, NE NW Sec. 5-18-7w.
Drlg. 2,015 ft.

Stark & Wells' No. 1 Smith, NW cor. Sec. 30-19-8w.
Location.

Langston et al's No. 1 Markle, NE SW Sec. 1-20-9w.
T.D. 2,425 ft.; S.D.

Robertson et al's No. 1 Johnson, NW cor SW Sec. 22-19-8w.
S.D. at 2,850 ft.

Yingling et al's No. 1 Maupin, NW SW SW Sec. 1-18-8w.
Drlg. 260 ft.

ROOKS COUNTY

Ashby et al's No. 1 Doughty, C SW SW Sec. 15-8-19w.
T.D. 3,130 ft.; U.R. 6-in. csg.

Phillips Pet. Co.'s No. 1 Dopita, C SW SW Sec. 31-8-17w.
Siliceous lime 3,409-19 ft., T.D.; 1,900 ft. swabbed 178 bbls. 24 hrs.; comp.

RUSSELL COUNTY

Blair et al's No. 1 Funk, SW NW SE Sec. 16-14-14w.
Location.

Eldorado Ref. Co.'s No. 1 Stratman, SW SE SE Sec. 32-14-11w.
Location.

Lario et al's No. 1 Neidenthal, NE NE Sec. 23-14-15w.
Drlg. 3,900 ft.

SCOTT COUNTY

Atlantic Oil Prod. Co.'s No. 1 Vaniman, C SE NE Sec. 15-20-32w.
Set 12-in. pipe 242 ft.; drlg. cmt.

SEDGWICK COUNTY

Jones, Kirk et al's No. 1 McQuillan, NE NW NE Section 21-29-2w.
Drlg. 1,300 ft.

Shawver et al's No. 1 Schulte, NE NE Sec. 13-28-2w.
6-in. 3,393 ft.; T.D. 3,490 ft. in chat; show oil, gas and water; bailing.

Sovereign Oil Co.'s No. 1 Nichols, C NW SE Sec. 20-25-1w.
T.D. 2,554 ft.; running 5-in. csg.

Trees Oil, Derby Oil et al's No. 1 McMinn, NW SW NE Sec. 36-26-1e.
Drlg. 2,283 ft.

SUMNER COUNTY

Morgan & Flynn's No. 1 Mercer, NW NE NW Sec. 36-32-1w.
Set 6-in. csg. 3,720 ft.; S.D. for repairs; T.D. 3,755 ft.

Wentz and Continental's No. 1 Small, NW SW Sec. 5-33-4w.
Drlg. 2,570 ft.

TREGO COUNTY

Alma Pet. Co. et al's No. 1 Rhodes estate, SW SW Sec. 14-11-23w.
Siliceous lime 3,978 ft.; T.D. 4,222 ft.; H F.W.; P.B. 3,605 ft.; swb. 30 bbls oil and 120 bbls. wtr.; drilled to 3,637 ft.; wtr.; P.B. to 3,620 ft.

Mid-Kansas O. & G. Co.'s No. 1 Kline, SW SE Sec. 19-14-24w.
Set 12-in. 1,975 ft.; drlg. 2,055 ft.

WASHINGTON COUNTY

Rose Oil Co. et al's No. 1 Penwell, NE NW SE NE Sec. 16-3-3 (O.W.D.D).
Old T.D. 1,720 ft.; R.U. and S.D

WOODSON COUNTY

Schwartz et al's No. 1 Collins, SW NW NE Sec. 30-23-14.
S.D. 300 ft.

DRAKE STAMP CACHET

To celebrate the drilling of the first oil well in the United States, August 27, 1859, the American Petroleum Institute will sponsor a cachet under the direction of Harold Walton, New York cachet director. Collectors' covers to receive the cachet should be sent to Harold Walton, cachet director, Room 2040, 50 West Fiftieth Street, New York. Service will be provided gratis to each collector who sends an envelope with a 3-cent stamp affixed, but a 5-cent charge will be made for each additional cover requested. In each envelope left unsealed a jubilee program will be enclosed.

OLD LINE REPLACED

GRANUM, Alberta, Aug. 18.—The Canadian Western Natural Gas, Light, Heat & Power Co. of Calgary is replacing portions of its main transmission line in this vicinity which have been affected by corrosion. The original line was laid more than 20 years ago. The new lines are vrapped and treated to resist corrosion

CELEBRATES 90TH BIRTHDAY

PETROLIA, Ontario, Aug. 18.—John Scott, provincial inspector of oil and gas wells for Ontario, celebrated his ninetieth birthday on August 11. In 1871 with his brother, the late Noble Scott, he interested himself in the Petrolia oil development, drilling many of the largest producing wells in this field. Some 25 years ago he was appointed oil and gas inspector for Ontario, a position he still holds.

G. A. STACK DIES

Gerald A. (Jerry) Stack, 45 years old, of the land department of the Sinclair Prairie Oil Co., shot and killed himself in a hotel at Casper, Wyo., last week. In a note to his wife he gave ill health as the reason for the act, authorities said. Mr. Stack left his Tulsa home a week ago to join his wife and children on a vacation in Wyoming. He was born in Lander, Wyo. He joined the Producers & Refiners Corp. during the Salt Creek boom of 1917.

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PRODUCING OIL ROYALTIES
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Inquiries invited from Oil Companies, Bankers, Dealers.
DAVID R. MITCHELL & CO.,
Established 1916.
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Income Producing Royalties
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Write for Dealers Contract on WASHINGTON-CAREY Trust Certificates. Latest offering of the group of Trusts sponsored by The Southwest Company. Registered in compliance with Federal Security Act. Liberal Spread.
SOUTHWEST TRUST DISTRIBUTORS
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1108 Sixteenth St., Washington, D. C.

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Dealers in Oil Royalties since 1918.

BROKERS-SALESMAN
The scene of the next big oil boom—The Permian Basin in West Texas and New Mexico—Can supply you with drilling blocks, close in acreage to Major Oil Companies drilling blocks or choice non-producing royalties located on geophysical highs—I have my own field men covering this area. Inquiries invited.
B. D. BUCKLEY
Paul Brown Bldg., St. Louis, Mo.

HIGH GRADE producing oil and gas royalties offered to dealers. Billie Smallwood. P. O. Box 2261, Tulsa, Okla.

BROKERS and Salesman wanted who can sell semi-proven leases and royalty Adjacent to the great East Texas Fields
TEXAS WHOLESALE LEASE CO
4148 Cole Avenue
Dallas, Texas.

PRODUCING OIL ROYALTIES
for dealers.
H. P. BOWEN
842 Kennedy Bldg., Tulsa, Okla.

PRODUCING ROYALTY—Owner will sell half acres and upwards of monthly income paying royalties at reasonable prices. P. O. Box 35, Tulsa, Okla.

HIGH-CLASS royalty under and offsetting drilling wells, Kansas, Oklahoma and Texas. Also producing royalties. Wire for offerings. J. E. Perkins, P. O. Box 2152, Tulsa, Okla.

Royalties—Production

ANDREW J. BARRETT
The Philtower
Tulsa, Oklahoma

CHOICE OIL ROYALTIES Registered with Federal Trade Commission. Wholesale only. Ask for our Free Royalty Booklet.
ROYALTY INVESTMENTS CORPORATION
Suite 641 Kennedy Bldg., Tulsa, Okla.

ROYALTY, Lses., Drill., Cont., Edmond Sector. F. T. GEE, Edmond, Oklahoma.

PRODUCING and nonproducing royalties, Kansas, Okla. and Texas. JAMES R. HAYNES, Grantville, Kansas.

ROYALTIES CAREFULLY SELECTED
G. D. TERRIEN
Philcade Building. Tulsa, Okla.

Leases—Production

NEW MEXICO Oil and Gas Leases and royalties. Send 50 cents in stamps for new State Oil Map of New Mexico Roy G. Barton, Clovis, New Mexico.

NEW Discovery of locating oil pools. Fast, accurate, economical. Lit. Free. Laboratory, 957 Davis, Fort Worth, Tex.

Andrews, Gaines, Yoakum and other counties fee Leases-Royalties for sale cheap. Address Owners American Investment Company, San Antonio, Texas.

MAJOR OIL COMPANIES
I can sell you a 10 year Oil Lease on a 20,000 acre Ranch for $3.50 per acre and furnish water to drill. P. O. Box 1343 Big Spring, Texas.

PENNSYLVANIA OIL PROPERTIES
A number of high grade oil producing properties in the celebrated Bradford Oil Field can be obtained at reasonable prices today from which an excellent income is assured. Inquiries invited from interested parties.
VICTOR H. SAMUELSON, Realtor
Hooker-Fulton Bldg.
Bradford, Pennsylvania.

FOR SALE—Oil and gas leases in shallow territory and on proven oil structures. Will furnish block of leases for contract to drill and case one or more wells. Depth of drilling is at 350 to 650 feet. W. P. HARLEY, Bowling Green, Ky.

ACREAGE for sale or lease in the Stuck Springs area, Marion County, Ala. Geological structures in favorable line with Amory, Miss., Gas field. D. Cooper, Hamilton, Ala.

EAST Texas Woodbine Sand wildcats just starting. Leases Royalties that might make you 50 for 1. E. Croft, Proctor, Tex.

EAST TEXAS PROVEN OIL LEASE
Want responsible party to drill 3 wells on Proven East Texas Lease. Would consider selling all or a part of the lease. Good commercial title.
Texas Producing Oil Royalty Co.,
S. W. Life Ins. Bldg.
Dallas, Texas.

CLASSIFIED ADVERTISING

For Sale—Equipment

COMPLETE LEASE EQUIPMENT—We are now salvaging a large producing property near Corsicana, Texas, and have large quantities of Casing, Line Pipe, Derricks, Powers, and other lease and production equipment to dispose of at exceptionally good prices. Considerable saving may be made by taking material from lease location before it is moved into stocks. Write, phone, or wire for prices delivered anywhere in the Mid-Continent or Gulf Coast or f.o.b. the lease. For further information contact Roy Sigmon on the Powell Lease near Corsicana; Ralph Hague, phone 4-8580, Tulsa, or our Wichita, Kansas, office, phone LD 59.

50,000-FT. 7-IN. O.D. LAPWELD—This large quantity of once-run 7-in. O.D., 24-lb., Lapweld Casing is now being pulled. Most any quantity wanted now ready for delivery from lease location near Corsicana, Texas. Moving and handling costs can be saved by taking it from present location. This is excellent pipe and a genuine value as priced where it lays. For price contact Roy Sigmon on the lease in the Powell field near Corsicana; Ralph Hague, phone 4-8580; or Wichita, Kansas, office.

DRILL PIPE CASING—Thoroughly shopped in our plant the Bridgeport way—new threads, new couplings—guaranteed first quality pipe. Made from good grade of 6⅝ O.D. (6¼) Drill Pipe. Makes economical and practical oil string. Several strings now ready for delivery from Wichita, Kansas, and Kilgore, Texas, yards.

FAIRBANKS-MORSE DIESEL DRILLING POWER—Technically 85% new—the same as new for all practical purposes, 90-h.p., 6-cylinder, late type, Fairbanks-Morse Portable Diesel Cable Tool Drilling Engine complete in every respect and mounted with drilling motion control. Included with engine is two speed Roller Bearing, Neutral Brake Reversing O.C.S., Type 2-SP, Countershaft with air cooled clutches; portable Air Starting and Lighting unit, with 6-h.p. FM gasoline Engine, Air Compressor and Compression Tank, 2½-KW, FM D.C. Chain Driven Generator, and steel fuel tank. Weight of complete unit is 17,000 lbs. The engine and equipment is being completely overhauled in our shops and will be ready for delivery within a few days. Price $3,750 f.o.b. Wichita, Kansas.

COMPLETE PUMPING POWER—Offered as it now stands on the Robinson lease, near Henryetta, Okla., for the exceptionally low price of $550. Equipment consists of 25-h.p., Marion Engine; 18-ft. Marion Band Wheel; Belt; Galvanized Steel Building; 250-bbl. Steel Circulating Tank; and ¾-in. Pull Rods and Sucker Rods to equip two wells. Equipment may be inspected on the lease. This is the last of the equipment on this lease which we have recently salvaged which accounts for this very low price. Contact Ralph Hague, phone 4-8580 or Wichita Office for further details.

12½-IN. LAPWELD CASING—Approximately 1,000-ft. now on hand in Tulsa yards. Phone Ralph Hague, 4-8580 Tulsa, or Wichita Office for details.

(All items offered subject to prior sale.)

Wire, or Phone—"Station to Station"—nearest Branch Store or Wichita Office for information on any item listed.

THE BRIDGEPORT MACHINE COMPANY
WICHITA, KANSAS.

For Sale—Equipment

REFINERY EQIPMENT AND STORAGE TANKS

Dismantling late type refineries, complete line of equipment, including all sizes steel storage tanks, pumps, pipe, fittings, stills and complete Carbondale Wax plant. Same as new. Also Oil and Gas Engines. Wire, phone or write.

SONKEN-GALAMBA CORPORATION
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SEMI-DIESEL TYPE PUMPING ENGINE—Completely overhauled and in practically new condition, 40-h.p., Weber, Semi-Diesel Type, Oil Engine with straight type Clutch and fuel tank. Condition of this engine is guaranteed. Attractive value at $850 f.o.b. Wichita, Kans.

THE BRIDGEPORT MACHINE COMPANY
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HOLT Caterpillar crawler tractors almost new, 5-ton size $350; 10-ton $750. Have winch for 10-ton. Location, Ky., Pa., N. Carolina. O. C. Evans, Mt. Sterling, Ky.

ENGINES—Oil and Gas

2—600 HP McIntosh-Seymour 6 cyl Diesels, actually operated only 8,000 hours each. Ideal for direct connected purposes. Complete with all auxiliaries. Specially priced $8,000 for one or $15,000 for both. Located Teapot Dome pumping station, Casper, Wyo.

2—500 HP Winton 8 cylinder gasoline or gas engines. Purchased new in May, 1933, operated only 6 months. Price, with all auxiliaries, now $4,500 each or both for $8,500. Located at Kansas City.

14—60 HP Worthington 2-cylinder vertical Diesels. Operated less than a year. Sonken-Galamba price, $800 each.

6—60 HP de LaVergne single horizontal cylinder Diesel. Complete. Now $700 each.

These engines are guaranteed to be in A-1 condition. Each one complete and ready for immediate shipment. When you need any type of plant equipment at money-saving prices, wire, write or phone to

SONKEN-GALAMBA CORP.
64 N. 2nd Kansas City, Kansas.

FOR SALE—Complete rotary drilling rig, two 66 HP boilers, 1,500 ft. 4-inch drill pipe. Drawworks, Tools, etc. Owner. 2564 Cockrell Ave., Fort Worth, Tex.

3—266 Walsh-Weidner water tube boilers—200 lb. rating—good condition and a bargain. Louisiana Iron and Supply Co., Shreveport, La.

For Sale—Equipment

3—25 HP Superior Gas Engines, comp.
1—3x24 Gaso Power Pump.
Complete String Cable Tools.
FRED KLINGENSMITH
Phone M 52, Route No. 2, Mounds, Okla.

FOR SALE
GAS-ENGINE COMPRESSOR, Cooper-Bessemer, four cycle, horizontal, 100 h.p., capacity 245 cu. ft. per min. In first class condition and priced to move quickly. Location, West Virginia. Address Box G-271, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE—Quantity of new 3" 250 SWP OS&Y Flanged and 6" and 8" Standard OS&Y Flanged Gate Valves. I.T.I.O. Company, Bartlesville, Okla.

FOR SALE: 7.6 miles Toncan Naylor 20" pipe line, complete with Victaulic couplings and valves. In ground 2½ years; painted inside and out; like new. Will sell in ground or racked at railroad siding. Address P. O. Box 2523, Tulsa, Okla.

25 K.W. and 40 K.W. Gas Engines, 220 volts, D.C. Two 100 K.W. Gas Engine Generator Sets, 220 volts, D.C. 7x6 Ingersoll-Rand ER-1 Air Compressor. Six-inch Oster Pipe Threading Machine. Also, large stock of lathes, pipe machines, milling machines, etc. Send for our list.
Terms to suit.
CINCINNATI MACHINERY & SUPPLY CO.
26 West 2nd St. Cincinnati, Ohio.

FOR SALE—A quantity of used, reconditioned, 2" Upset, 2½" Upset 10 Thread A.P.I. P & T Kick Off Collars. I.T.I.O. Company, Bartlesville, Okla.

Equipment Wanted

WANT Natural Gasoline Plant; cap. 3 to 10 million ft. lean gas. Also Carbon Black Plant, like capacity 1105 Sherman St., Apt. 4, Denver, Colo.

WANTED—One drilling pump, for power drive, approximately 5"x7", duplex. Sutter Well Works, Pass Christian, Miss.

Classified Rates

Classified Advertising rates are 35 cents a line for the first insertion and 25 cents a line for each additional insertion, PAYABLE IN ADVANCE.

Six words usually constitute a line.

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3 lines	$1.05	$1.80	$2.55	$3.30
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5 lines	1.75	3.00	4.25	5.50
6 lines	2.10	3.60	5.10	6.60
7 lines	2.45	4.20	5.95	7.70
8 lines	2.80	4.80	6.80	8.80
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10 lines	3.50	6.00	8.50	11.00

To avoid delay be sure to send remittance with copy. Over payments will be refunded. One time insertions will not be run until fully paid.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

Display Rates

Classified Display Advertising set in similar style to this Ad or in two-column style is as follows:

1 inch	1 time	$5.00
1 inch	13 times	4.50
1 inch	26 times	4.00
1 inch	52 times	3.50

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MONTHLY

One-point borders and 10-point capitals are allowed: larger type not accepted.

To avoid delay be sure to send remittance with copy. Over payments will be refunded. One time insertions will not be run until fully paid.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

Equipment Wanted

WANTED—About 100-120 HP Diesel and AC Generator. 1,200 ft. 4" Pipe. 20-25 ton ice machine. Garden Farm Dairy, P. O. Box 363, Denver, Colorado.

WANTED to buy a small spudder or drilling machine, capable of drilling 1,500 feet. Give present location, price and condition in your reply. L. S. HARLOWE, P. O. Box 103, Shreveport, La.

Patent Attorneys

REGISTERED PATENT ATTORNEYS
United States and Canada
Before disclosing your invention to anyone, send for blank form:
"Evidence of Conception,"
Insructions "How to Establish Your Rights" and complete information FREE!
LANCASTER, ALLWINE & ROMMEL
418 Bowen Building,
Washington, D. C.

Incorporations

CHARTERS—Delaware best, quickest, cheapest, most liberal. Free forms. Colonial Charter Co., Wilmington, Del.

DELAWARE CHARTERS—Fees small; submitted forms. Chas. G. Guyer, 901 Market Street, Wilmington, Del.

Financing

JOHN MORRIS, Seventh Floor, 1237 Market Street, Philadelphia, will help float small deal. No stock selling. Send full facts in first letter.

LOANS on oil production available to owners of Royalty or Working Interests on settled Production. Loans may extend over a period of twelve months repaid monthly from runs. Forward full detailed information to Box G-132, The Oil and Gas Journal, Tulsa, Okla.

JAMES E. MILLER CO., 207½ E. Third St., Tulsa, Okla., will co-operate with responsible parties seeking aid in financing projects of higher order.

Oil Industry Printing

OIL FIELD LEGAL BLANKS
Leases, assignments, releases, township plat books, well records, etc. Request on your letterhead gets free catalog. Olds Press, 215 East Third St., Tulsa, Okla.

Business Opportunities

WANTED—Wholesale distributors for green cast naphthene base motor oils and gear greases. Advise requirements and your specifications. P. O. Box 425, Jackson, Miss.

Situations Wanted

Mechanical Draftsman with 9 years experience in Refining, Gasoline and Recovery Plants, Refinery Equipment, Plate work, Construction, Plant Operation, Piping, Patents, etc., is seeking an opportunity. Age 34. A-1 references. Box G-322, The Oil and Gas Journal, Tulsa, Okla.

Purchasing Executive—Chemical Engineer having ten years varied engineering and purchasing experience, capable of putting purchasing on scientific, economical basis, desires position as purchasing agent or assistant. Address Box G-324, The Oil and Gas Journal, Tulsa, Okla.

BRIGHT young man, 26, B.S., inventive, experienced; petroleum chemist, Dubbs plant operator, hydrogenation, seeks refinery opportunity, excellent references. Address Box G-325, The Oil and Gas Journal, Tulsa, Okla.

Help Wanted

WANTED—Sales representatives for oil gravity-testing instruments. Exclusive territories available. Liberal commissions. Widely-known instrument Company. Address Box G-323, The Oil and Gas Journal, Tulsa, Okla.

JUNIOR Research Petroleum Chemist wanted for a Western Pennsylvania Refinery. Experience with contact filtration desirable. Give particulars about previous employments and last salary. Address Box G-320, The Oil and Gas Journal, Tulsa, Okla.

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Kansas Fields

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Co.'s No. 5 Stoltenberg, NW SW Section 22-16-10w, made 990 bbls. in 24 hours in a potential test on the pump and was completed. The well is producing from Siliceous lime at 3,335-43 feet, which had been acidized.

Magnolia Petroleum Co. took a potential test at No. 2 Andrea, NE NW SW Section 7-17-10w, Kansas City lime at 3,026-3,125 feet was acidized. It pumped 208 bbls. in 24 hours and was completed. Same company made location for No. 3 Andrea, SW NW SW Section 7-17-10w. Torrey, Feaster and Gypsy Oil Co. have cellar dug for No. 1 Koots, NW cor. Section 7-17-9w.

Marion County

Harwood Oil Co.'s No. 3 Cowman, NW SE SW Section 11-17-4, Marion County, had 700 feet of oil in the hole from chat at 2,348-78 feet and was preparing to test.

Russell County

E. L. Price and others were building a rig for a wildcat test, No. 1 Ehrlich, NW SE Section 10-16-13w, Russell County.

Bridgeport Machine Co. had ponds dug for No. 14 Mermis, SE SW Section 33-13-15w.

Pat Ashby's No. 1 Whitson, NW SW SW Section 16-11-15w, pumped 523 bbls. in 24 hours from a pay at 3,130-75 feet which had been acidized. It will be retested.

After many weeks of testing Phillips Petroleum Co. has completed its No. 1 Dopita, C SW SW Section 31-8-17w, in Rooks County. It swabbed 178 bbls. in a 24-hour test. It is producing from Siliceous lime at 3,409-19 feet. It had showings of oil at various depths below 3,059 feet and had been acidized at four different levels. It was bottomed in Siliceous lime at 3,419 feet.

DIPPER WELL NEAR DRAKE

TITUSVILLE, Pa., Aug. 20.—Using two barrels, set end on end, as casing, the Killmyer & Tucker wildcat on the Pennsylvania railroad right of way within sight of the old Drake well, is producing three-quarters of a barrel of oil a day. The "sand" is 10 inches thick, and it has been determined that the yield has not strayed from leaking pipe lines. Permission to operate the "dipper well" was given by the railroad to William Killmyer of Titusville.

VISIT TO TURNER VALLEY

CALGARY, Alberta, Aug. 18.—A party of students composing the Princeton University Summer Geological School and headed by Dr. R. M. Field, head of the university geological department, recently made a motor trip to the Turner Valley Field. The party of 20 left later by special car "Princeton' for the British Columbia coal fields.

J. E. CARLTON DIES

PETROLIA, Ontario, Aug. 18.—James Edward Carlton, formerly well known in the Canadian fields, died recently at Detroit, in his fifty-ninth year, following a street car accident. A native of Marthaville, Ontario, Mr. Carlton became an oil expert and for some years operated a property at Oil Springs, later moving to Cleveland and Detroit.

DEATH OF JOHN P. DEVLIN

BRADFORD, Pa., Aug. 18.—John P. Devlin, oil producer and lawyer, of this city, was drowned in Canandohta Lake near Union City, Pa. Mr. Devlin became ill Monday night and it is believed he wandered from his party of fishermen and fell into the water. Mr. Devlin was 64 years old.

DEATH OF MRS. F. D. WOOD

BRADFORD, Pa., Aug. 18.—Mrs. Carrie Ball Wood, aged 82, wife of F. D. Wood of the Wood Oil Co., and mother of Harry B. Wood, Lexington, Ky., oil operator, died at her home here on August 15 after four years of ill health.